Cement MILL EDITION of
Concrete

Devoted to the Manufacture, and Use, of Portland Cement

JULY, 1935

400 West Madison Street
Chicago, Illinois

ANS'D
JUL - 1 1935
DATE
FOR REPLY

To Save the Highway Construction Program

THE work-relief program, for which the present Congress appropriated four billion dollars, clearly was designed to provide employment through the construction of permanent and useful public works projects.

¶ When the President requested this appropriation, he declared specifically that all work undertaken should be useful—not just for a day, or a year, but useful in the sense that it affords permanent improvement in living conditions or that it creates future new wealth for the nation.

¶ Further along in his message, the President made specific reference to the construction of national highways designed to handle modern traffic, and the elimination of grade crossings, as the type of work he had in mind.

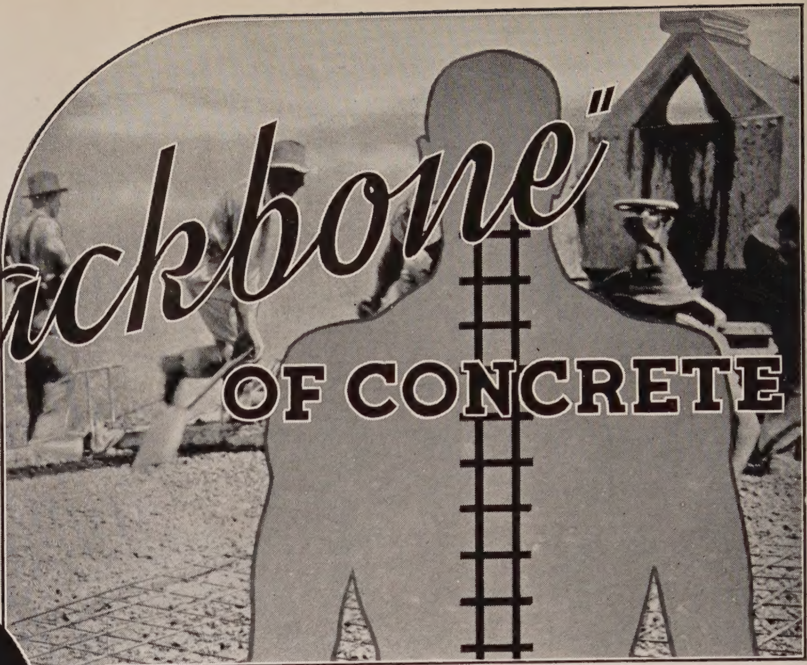
¶ Now the Works Progress Administration threatens to botch up the whole highway construction program through a foolish and impractical ruling which provides that for every $1,400 expended, one man is to be furnished work on the job for one year; and this figure must include all necessary materials and equipment as well as labor charges.

¶ Every construction man knows that high-class paved highways, grade-elimination structures, and the like, can not be built under this restriction.

¶ Unless the ruling is rescinded, the President's intentions will be completely upset; and, instead of modern highway construction, we shall have a glorified CWA.

¶ Highway construction groups are doing everything possible to get this unfortunate situation corrected. Individuals can help by writing or telegraphing to their members of Congress.

BACK OF THIS "Backbone" OF CONCRETE



IS PROVED QUALITY *and* SERVICE

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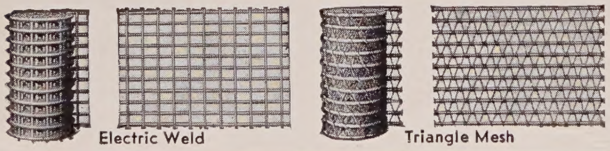

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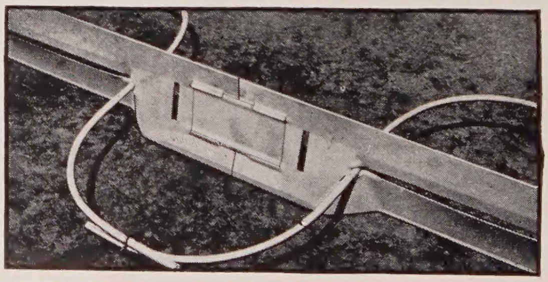

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Cement Mill Edition of CONCRETE, July, 1935. Vol. 43, No. 7. $4.00 per year, 50c per copy. Entered as second-class matter, August 14, 1925, at the postoffice at Chicago, Ill., under act of March 3, 1879. Published monthly by Concrete Publishing Company, Chicago, Ill.

VOL. XLIII, No. 7 Concrete JULY, 1935

Remodeling Does This—
to an Old Brick Theatre

Metal Lath and Cement Stucco Anchored to Old Brickwork—Color Harmonizes with Stone Trim—The Construction Procedure

PORTLAND cement stucco on metal lath stapled to the old brick wall was the construction material that transformed a dingy old brick theatre building in Chicago into the artistic structure here illustrated.

Typical Old Building

The old building was known as the Randolph Theatre, on the north side of Randolph Street, just west of State Street. While no photograph of the old building is available, it may easily be pictured mentally as a very old theatre building with a red brick front, wholly devoid of architectural merit, smoky and dingy in appearance.

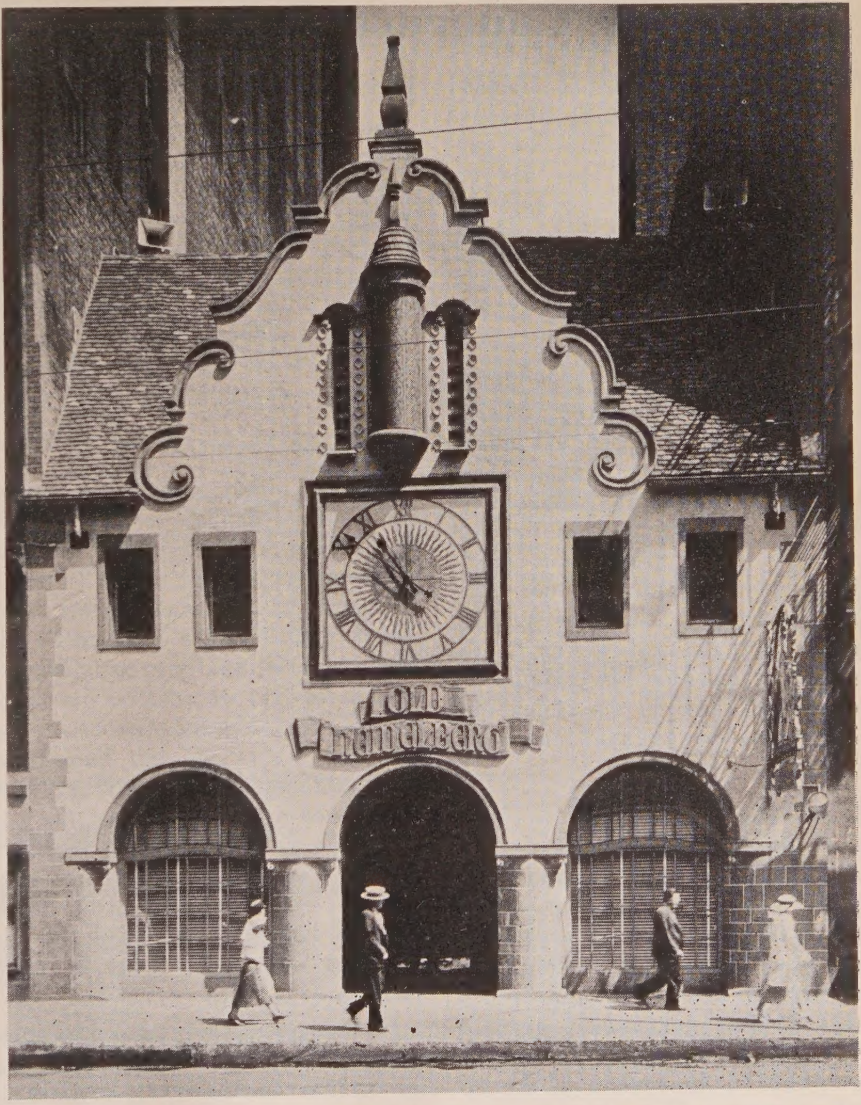
The modernized structure is known as Old Heidelberg, a high-class restaurant and place of entertainment which now attracts the after-theatre crowds of that part of Chicago's "loop."

While the interior of the building has been transformed into a luxurious example of the art of "Old Heidelberg," thoroughly in keeping with the architecture of the new exterior, this article will be confined to the remodeling of the exterior.

The Construction Procedure

Covering the old brick wall with a new and modern coat of armor was a relatively simple process. Steel rods of ¼-in. diameter—commonly known as "pencil rods"—were set vertically, 8 in. apart, and were stapled to the old brickwork at every sixth mortar joint. Metal lath was then placed in horizontal strips and was stapled to the pencil rods, by means of 2-in. staples driven over the rods and into every second mortar joint. This method of placing the metal lath reinforcement, it will be seen, provided a space of ¼ in. behind the lath for the scratch coat of stucco.

The portland cement stucco was applied in three coats, all placed by hand. The scratch coat just filled the space behind the metal lath, partially embedding the lath. The brown coat, of course, covered the metal lath complete-



An exterior armor of metal lath and cement stucco, combined with stone trim and the genius of a competent architect, produced this transformation of a dingy old theatre building ly, and provided a roughened base for the final coat. In this final coat an extremely pleasing light tan effect was obtained by the use of white cement and a small amount of mineral color, mixed with yellow sand. The finished texture was obtained with broad strokes of the trowel, but without going to extremes that in many cases are too obvious.

Exterior Trimstone

The square clock face is a cast stone slab, colored in harmony with the flat wall surface and the sandstone trim. All other exterior trim is a sandstone of a deep pinkish gray color.

"Old Heidelberg," as the illustration suggests, is a masterpiece in remodeling; but the fact remains that every city in the country, and even the smaller towns of a few thousand people, offer any number of similar opportunities to enterprising architects.

For Enterprising Architects

Armed with a few illustrations of this type—particularly where both the old and the remodeled structure can be shown—an architect should have little difficulty in gaining the attention of owners of old business buildings. These old structures, many of them built in the 1870's and the 1880's, present a drab and unkempt appearance that actually repels the shopper. If the exterior of the building—including the entrance and the show windows—presents a wholly out-moded appearance, the shopper feels instinctively that the merchandise inside the store is in keeping with the building. Moreover, the situation is one that can not be corrected by a few coats of paint.

On the other hand, every shopper likes to enter a store that has a modern and attractive front and artistic show windows, for in such a store she expects to find new stocks, new styles, and a wide range of choice.

Acknowledgments: Graham, Anderson, Probst and White, well known Chicago architects, designed both the exterior and the interior of the remodeled building here described. The general contract was held by the Krahl Construction Co., and Harold Sutton was the contracting plasterer who applied the coating of metal lath and portland cement stucco.

Colored and Textured Facings for Concrete Units

THERE are a number of practical methods for producing attractive colored and textured surfaces for concrete masonry units. These are described in brief in a "concrete information" sheet issued by the Portland Cement Association, 33 W. Grand Ave., Chicago.

Coloring by Mineral Oxides

Color may be obtained by the use of pure mineral oxides especially prepared for use in concrete which are mixed with the cement and sand facing. These are available from white, obtained by using white cements, through the yellows, buffs, reds, greens and blues. Ordinary mortar colors are not satisfactory. Depth of color or varying shades, from light to dark, can be obtained by controlling the amount of mineral oxide used in the facing mix or by mixing two or more colors together.

Colored Aggregates

In addition to the above method of obtaining color, the use of colored aggregates, with or without the use of mineral oxides, produces pleasing color effects when used in the facing mix. When facings are made with colored aggregates, they are usually given a dilute muriatic acid wash to remove the cement film on the surface of the exposed aggregate. This also serves to give a slightly roughened texture to the surface.

Portland Cement Paint

Another method consists of coloring the concrete building unit immediately after molding by spraying on the exposed face a portland cement paint of the desired color. Two-tone effects can be obtained by this method, using the first coat as a base color and high-lighting with a different shade of the same color or a suitable contrasting color after the wall has been erected.

Producing Textures

The two principal ways of varying the texture of the unit are: (1) Varying the grading of the aggregate used, and the consistency of the mix; (2) the use of manual or mechanical means to give variety to the texture obtained by (1). The second is usually accomplished by the use of fine water spray or by the use of wire or bristle brushes to texture the face of the unit immediately after molding. When texturing is accomplished by manual means, the work frequently is rotated among the block-making crew to obtain attractive variations in texture. Operating the texturing tool first with one hand and then with the other also helps to obtain variation.

When texturing is produced by spraying, care should be taken not to etch the surface too deeply nor to wash out the cement in the face shell, thereby permitting water to go through the wall. It is recommended that a richer mix be used when texturing is done by this method and that the spraying be continued only long enough to remove the surface film and expose the aggregate. Units with exposed face shells less than 1¼ in. thick after texturing should not be used in walls exposed to the weather.

Cost

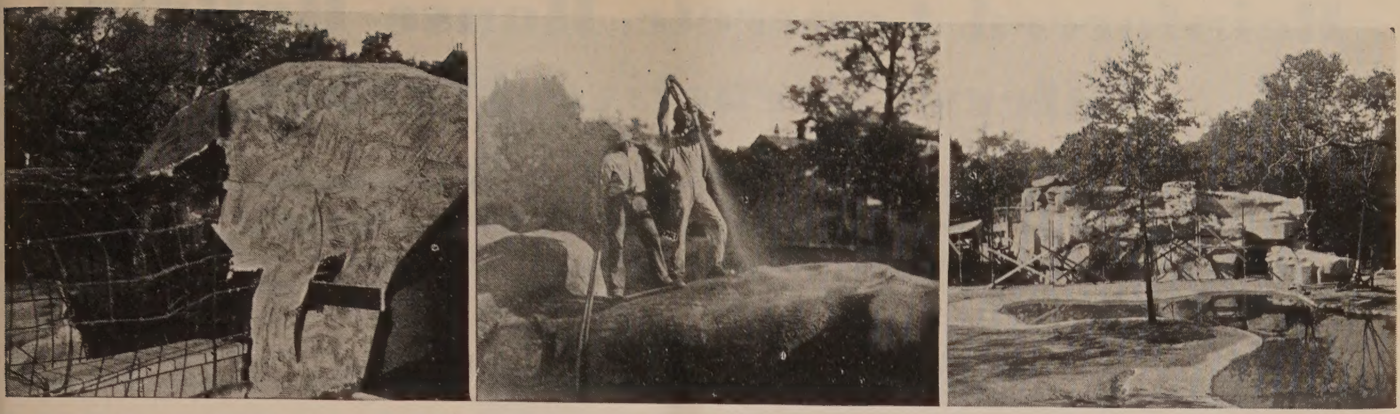
The cost of these various colored textures will range from 2 to 12 cents per square foot. This is in addition to the cost of the concrete units. The lower figure covers the cost of spraying the colored cement slurry on the freshly molded unit, and the higher figure is for a 3/16 to ⅜-in. colored facing, using colored aggregates, and finishing by washing with acid.

With the wide range in color and texture available, it is possible to make, within reasonable limitations, faced concrete units having textured surfaces to meet any definite architectural requirements.

Construction Volume on Increase

"While construction costs look high on paper," says the *Brookmire* report of June 5, "there is reason to believe that the wage element is much more equitably adjusted than is generally believed. Rents continue to improve."

That such costs are little handicap to construction activity is evidenced by recent figures on residential building volumes. During April, building permits in 792 cities were 65 per cent higher in value than a year ago, with new residential construction recording a gain of 123 per cent."



At left, framework of steel rods and 24-gauge wire mesh are in place, partly covered by scratch coat of portland cement mortar. Center picture shows cement gun operation, gunite being applied both inside and outside the scratch coat. At right, the completed African veldt

Natural Animal Homes of Concrete

Cincinnati Zoological Gardens Provide Freedom and Familiar Surroundings for Wild Animals — How Rock-Like Grottoes Are Built

CINCINNATI'S "Zoo" is rapidly adding to its already famous attractions a series of natural animal inclosures. The first three projects provide tiger, lion and bird grottoes. The fourth project, recently completed, is an African veldt. Zebras, ostriches, antelopes and other animals native to Africa will live in natural surroundings. A kopje, similar to those found in Africa, is reproduced in the African veldt. Realistic pools are also being provided for the hippopotamus.

The Construction Procedure

The method of construction, as outlined by C. E. Kern, landscape architect, starts from a model of the project. Following this model very closely, a framework of mild steel bars is erected. These bars, consisting of ¼, ⅜ and ⅝-in. sizes, are wired together at 6 to 8-in. spacings, as shown in the picture at the left. On this framework, diamond japan-dipped 24-gauge mesh is wired and molded to shape. A scratch coat of portland cement stucco, also illustrated in the picture on the left, is applied by trowel.

This operation is followed by a cement gun, which builds up the concrete or mortar inside and outside, to a thickness of 1 in .or more. The mix used is one part of cement to three parts of sharp mortar sand. While the gunite, or mortar coat is still plastic, Mr. Kern hand-sculptures the various fissures and cracks that provide the realistic stone appearance. These fissures and depressions are landscaped with vines and shrubs typical of the natural surroundings in which the animals once lived.

More Construction Planned

The Zoological Gardens were opened to the public of Cincinnati on September 18, 1875, and the 59th anniversary of the Zoo was celebrated this year with extensive ceremonies, inasmuch as the previous twelve months had witnessed great improvements in the new grottoes and in gifts of many rare animals. Sol A. Stephan, general manager, is considered one of the world's leading authorities on confined wild animals. An extensive building program is planned whereby many more barless grottoes will be built at the Cincinnati Zoo, within the next few years. In the immediate future is the project of construction of a large grotto for the six young polar bears given the Zoo by Powell Crosley, Jr., internationally known radio manufacturer.

Acknowledgments: The Zoological Gardens are under the jurisdiction of the Zoological Society of Cincinnati, of which James A. Reilly is president, and N. S. Hastings is secretary. The work here described and illustrated was designed by C. E. Kern, landscape architect.

Paved Road Maintenance

Comparison of Road Maintenance Costs in Minnesota

ACCORDING to the biennial report of the Minnesota state highway department, it cost $6,445.41 to maintain the 33.9 miles on trunk highway 19, through Redwood County. This is a paved route carrying heavy traffic. This made the average cost only $190 per mile. The upkeep cost on the 26.6 miles on U. S. 71, although it carried much less traffic, was $9,228, or $346 per mile. This road is untreated gravel.

The contrast in Renville County is still more striking. On the 19.4 miles on highway 19, all paved, the maintenance cost was $3,305.95, or $170 per mile. On 71, which is a bituminous gravel road, the report shows a maintenance expenditure of $36,428 for 23 miles, an average of $1,582 per mile. On highway 4 through Renville County, which is untreated gravel most of the way, the expenditure was $31,173.40 on 31.3 miles, or nearly $1,000 per mile. But on U. S. 212, which is paved the whole length of Renville County, it cost only $11,124.07 to maintain 49.5 miles, or $224 per mile.

Although maintenance costs are lowest on concrete, the road is always in good condition. — *Redwood Falls* (Minn.) *Gazette.*

Reinforced Concrete House Building Offers Attractive Market

Only Type That Meets All Service Requirements—Resists Violent Storms and Rains, Fires, Earthquakes, Hot and Cold Weather, Ground Water, and Termites

By E. W. DIENHART
Cement Products Bureau, Portland Cement Association, Chicago

HOUSING, especially better housing, is receiving more thought, attention and publicity than ever before. Industry, financial institutions, governmental agencies and the people as a whole are housing-minded. The pent-up demand, now conservatively set at 1,500,000 housing units plus the actual shortage of homes in many centers, is the principal cause of the keen interest displayed in every quarter.

Biggest Volume Since 1931

In spite of the numerous obstacles interfering with immediate resumption of house building on a large scale, we now have a substantially increased number of houses under construction. Building permits so far this year are at a rate indicating that 1935 will show the greatest volume of residential construction since 1931. For all we know, we may have started a definite resumption of home building that will continue to expand and carry us on to the normal volume of about 400,000 residential units annually.

What kind of houses are we going to sell the public in this next housing era? Are they going to be the same type of shoddy construction that characterized too many of the houses built heretofore? They need not be.

Service Expected of House

Let's tackle this problem from a logical viewpoint by analyzing the service expected and the conditions and hazards to be met.

With regard to service, it seems fair that home owners should be entitled to the kind of structure that is—

1. Attractive.
2. Permanently rigid.
    a. Walls stay straight, plumb and tight.
    b. Floors stay level and prevent squeaks.
    c. Partitions do not settle.
    d. Plaster cracks are reduced to a minimum.
    e. Door and window frames stay level, plumb and square.
3. Reasonably maintenance-free.
4. Firesafe — Stormproof—Termite-proof — Watertight—Not subject to decay.
5. Well insulated to provide economical heating in winter—Cool in summer.

Now let us examine the elements that house structures must be built to resist: Cold winters, hot summers, rain, wind, fire, ground water, termites, earthquakes. Fortunately, not all houses are called upon to resist all of these hazards, although all houses are required to resist most of them.

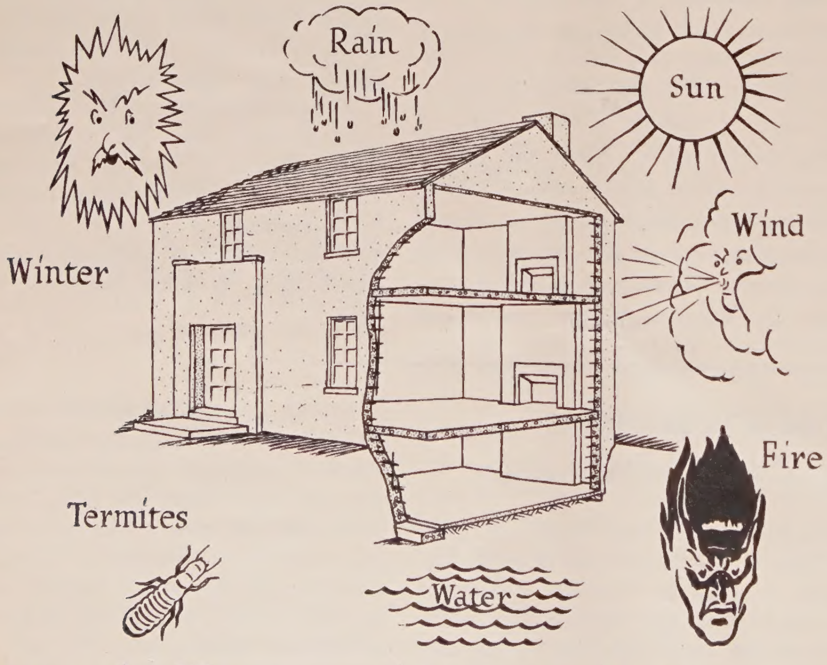
The Answer Is Reinforced Concrete

In the violent stage of most of these elements, such as blizzards, floods, tornadoes, fire, water, termite infestation, and earthquakes, there is only one material — *reinforced concrete* — that can measure up to all of these conditions.

Reinforced concrete[1] is the logical answer to the problem of building houses —"Houses That Take Care of Themselves."

Since concrete was first introduced, thousands of reinforced concrete houses have been erected. Some of these date back to 1850 and 1860, and today they demonstrate the time-defying qualities of concrete. The early houses were quite expensive due to lack of familiarity with concrete construction and because forms were cumbersome and costly.

Improvements in the technique of mixing and placing concrete, together



Design the Home to withstand the Elements

Fig. 1—The modern home must resist these attacking forces of nature

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[1] The Portland Cement Association, 33 West Grand Ave., Chicago, has prepared detailed information on *Reinforced Concrete House Construction.* Those interested are invited to write them.

with a marked advance in the simplicity and economy of erecting forms, justifies accelerated interest in the application of reinforced concrete to house construction.

Take the Factory to the Job

Much publicity has been given to the idea that prefabricated factory-built houses offer the best solution to the economical construction of low-cost houses. Most students of the subject seem to be in accord with the thought that the inherent characteristics of housing do not permit of much optimism in that field. Problems of transportation, varying taste and attitude of labor organizations, weigh against successful mass production of factory made houses.

There is an opportunity, however, to apply to the reinforced concrete house many of the economies sought by factory production, where builders will equip themselves with easily-transported equipment that can be set up on the building site and used for the entire structural part of the house—walls, partitions, floors and roof. In other words, "take the factory to the job."

In locations where it is possible to use the same crew for all operations—setting forms, setting reinforcing steel and placing concrete—there is no question that the advantages of reinforced concrete can be incorporated into a building with speed at very low cost.

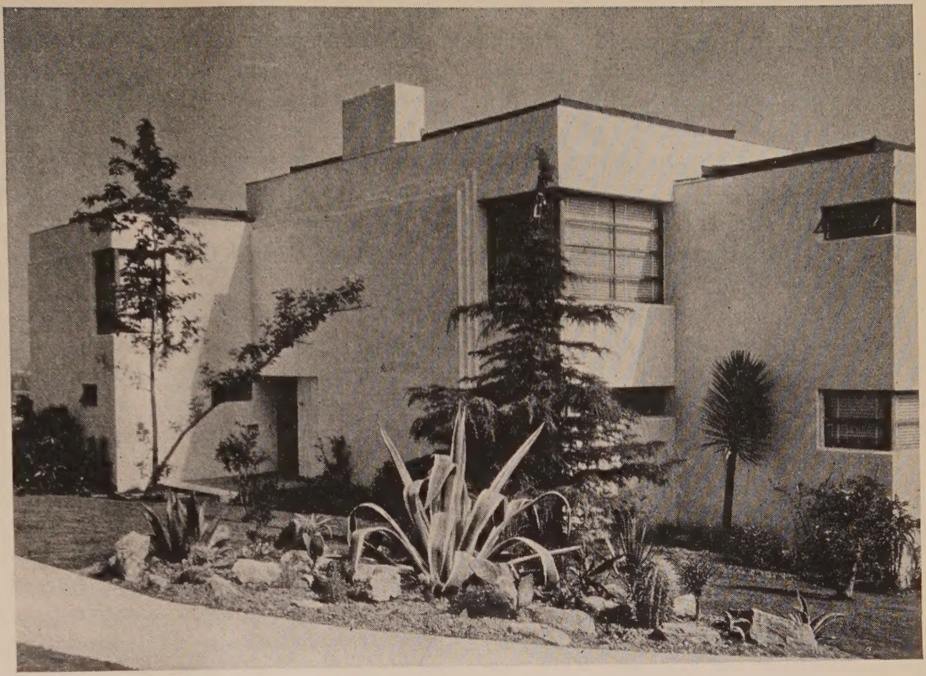

Fig. 2—Typical reinforced concrete home of modern flat-roof type, brought to front by Century of Progress and General Electric architectural competition

Notes on the Construction of Reinforced Concrete Houses

TYPES OF WALLS: The construction of reinforced concrete walls can be divided into three groups:

1. Monolithic reinforced concrete cast in forms at the building site.
2. Large precast reinforced concrete units, generally factory made and assembled on the job.
3. Small machine-made units, reinforced by embedding steel bars in the horizontal joints and in hollow vertical cores.

General contractors, concrete contractors and manufacturers of ready-mixed concrete are probably most interested in the first classification — monolithic reinforced concrete cast in forms at the building site. These notes apply specifically to that type of walls. They may be subdivided into four general types:

1. Solid concrete walls, insulation applied to interior surface.
2. Hollow double wall, continuous air space to provide insulation; additional insulation obtained by filling hollow space with insulating materials.
3. Insulated double wall, rigid insulation built into the wall—permits use of both exterior and interior surfaces of finished walls.
4. Ribbed wall. Sturdy construction with a minimum volume of concrete. Rigid insulation applied to interior face of ribs, or lath and plaster with flexible insulation in the hollow space.

FORMS: Economy of form costs will depend upon simplicity, speed of erection and number of re-uses. The use of standard panel forms similar to those manufactured by the Metal Forms Company, of Milwaukee, and the Universal Form Clamp Company, of Chicago, are especially adapted. Some builders will prefer to construct panel forms of their own design.

REINFORCEMENT: Proper distribution and placing of reinforcing steel is important. Design data sheets show typical bar steel reinforcement for various types of concrete walls. Wire mesh of equivalent effective area may be used. Care must be exercised to insure adequate reinforcement around door and window openings. In addition to regular wall reinforcement, round steel bars should be added over the top, under the bottom and in the jambs of all door and window openings.

PARTITIONS: Interior load-bearing walls should be anchored to the exterior walls (See details in Fig. 1). Under some conditions, it may be economical to build load and non-load bearing interior walls of concrete masonry. In this case, connecting reinforcement may be embedded in the masonry joints.

FLOORS: For the most sound construction, it is logical that concrete floors be used. Reinforced concrete floors of either the flat slab, ribbed joist, tile and joist, or precast concrete joist types, are applicable. Economy of construction will depend to a great degree on the ceiling effect desired and the contractors' equipment and familiarity with an individual type.

UTILITY PROVISIONS: Before construction begins, contractors for heating, plumbing and electric wiring should be consulted to determine locations of outlets and position of pipes and fixtures. Utilities are best provided for when plans are drawn.

MIXING AND PLACING CONCRETE: Concrete can be mixed on the job, or ready-mixed concrete may be purchased. Care must be exercised in the selection of aggregates, proportioning of mix and amount of mixing water, so that the concrete may be readily placed in the forms to produce dense, strong, watertight concrete. For walls 6 in. thick and under, aggregates should not be larger than 1 in. Not more than 7 gallons of water per sack of cement should be used. Generally, a mix of 1 part cement, 2¼ parts of fine aggregate and 3 parts of coarse aggregate will be satisfactory. Use of too dry or too *wet* mixes should be avoided.

Concrete should be placed to a depth that can easily be spaded. Placing should be as continuous as possible. Where work is stopped for the day, it is advisable to stop at the tops of windows and door openings, to permit settlement.

Exterior Finishes: The essential function of reinforced concrete walls and floors is to provide a permanently rigid structure. Maximum economy is obtained by producing a concrete wall of a finish suitable to be left exposed, although any desired exterior or interior finish may be applied.

Concrete walls are truly beautiful when finished with white or colored portland cement paint. Sand may be added to the paint to provide interesting textures. Other textures may be obtained by wire brushing or sand blasting. Portland cement stucco may be applied direct to the concrete walls, or they may be veneered with face brick.

Insulation: Walls, floors, and particularly roofs, of all materials require insulation in some form. Properly insulated walls will be free from condensation—they will not sweat. When the insulation problem is understood and provision is made accordingly, materials can be combined to provide warm concrete walls of the required degree of insulation (See details in Fig. 1). The dense character of concrete prevents infiltration of air and aids insulation.

Interior Finishes; Walls; Floors; Ceilings: One method of interior finish consists of the use of insulating board, which also serves as a base for plaster. This may be applied directly to the concrete walls with an asphalt binder, or nailed to plugs or strips embedded in the concrete; or it may be furred out from the wall with 1 by 2-in. or 2 by 2-in. strips. Furred metal lath and plaster construction, either in combination with insulating materials or without them, is frequently used.

Some builders, striving for maximum economy, build concrete walls so they will serve as an interior finish ready for painting. In this case, it is necessary to provide insulation within the body of the wall. The "Hollow double wall" and the "Insulated double wall" are particularly adapted to this treatment.

Other builders eliminate plaster and utilize the insulating materials for interior wall finish. Many attractive, modern interiors are obtained in this manner. Wood panels of "knotty pine" and "pecky cypress" also are used for this purpose.

Any kind of floor finish may be had—terrazzo, colored concrete, rubber tile, wood, linoleum or carpeting.

Ceilings may be finished in a variety of ways. Plaster can be applied direct to the underside of flat-slab and tile-and-joist floors. For ribbed and precast concrete joist floors metal lath and plaster are applicable.

With careful workmanship, flat-slab floors may be finished ready for painting. Precast concrete joists may be left exposed and painted to provide an attractive beam ceiling effect at a very moderate cost.

General Electric
Demonstration Home Is Concrete

Thousands of Visitors Vote Favorably on Flat-Roof Type of Architecture

THOUSANDS of visitors have inspected the demonstration house built by the General Electric Co. at Nela Park, Cleveland, to exhibit the use of available material in modern home construction.

The walls of the Nela Park house, shown in the illustration, are built of haydite concrete wall units, surfaced with portland cement stucco—a combination which, like monolithic concrete walls coated with stucco, provides the broad surfaces so well adapted to this type of architecture.

An interesting sidelight was obtained regarding the popular interest in the flat roof for dwelling houses. Visitors were asked to answer certain questions, on forms provided for the purpose. One question was whether the visitor would prefer the flat roof, provided it would result in a saving of $500. To this question, more than 65 per cent of the visitors answered "yes." This question served the further purpose of driving home the fact that the flat roof costs substantially less than the pitched roof—an important point that was new to most of the visitors.

Hays and Simpson, Cleveland architects, and grand-prize winners in the small-home classification in the General Electric Company's nationwide architectural competition, designed the Nela Park demonstration home here illustrated.

Concrete demonstration home at Nela Park

E. W. Langdon, Manager of the reinforcing bar division of Joseph T. Ryerson & Son, of Chicago, was recently elected president of the Concrete Reinforcing Steel Institute. This group includes all of the mills selling new billet stock, and rail steel, and jobbers and distributors of reinforcing materials. The Institute has represented the reinforcing industry for the past eight years, bearing the same relation to the reinforcing group as the American Iron and Steel Institute bears to the general steel producing industry.

Allocate Four Hundred Millions for Highways

Wallace Apportions Federal Funds—Half of Sum for Grade-Crossing Elimination

SECRETARY of Agriculture Henry A. Wallace, on June 4, announced the apportionment among the states, the District of Columbia, and Hawaii, of $200,000,000 for highways, roads and streets, and $200,000,000 for elimination of hazards at railroad grade-crossings, under the Emergency Relief and Appropriation Act of 1935. These sums are allocations made by the advisory committee on allocations on May 16 and approved by the President.

The apportionment by Secretary Wallace has been made in accordance with the provisions of law which require that funds for highways and related projects be apportioned on the basis of population, area, and mileage of rural post roads, slightly more weight being given to population than to the other factors. Funds for work at grade-crossings were apportioned, one-half on the basis of population, one-fourth according to the mileage of the Federal-aid highway system and one-fourth according to railroad mileage.

An additional $100,000,000 was allocated by the advisory committee on allocations with which to meet obligations arising from the authorization of $200,000,000 for highways in the Hayden-Cartwright Act and apportioned by the Secretary of Agriculture on June 19, 1934. One-half of this amount has previously been appropriated.

The funds apportioned are not available for expenditure in any state until a program of the projects proposed to be undertaken in the state shall be submitted by its highway department and approved by the advisory committee on allotments.

It is also provided that no individual project will be approved for construction in any state until the highway department of the state has submitted and obtained approval of a program of projects that will absorb substantially all Federal emergency funds previously apportioned.

Subject to these conditions, the funds are available for immediate expenditure and will be administered through the Bureau of Public Roads. They are to be expended by the state highway departments, and it is expected that construction on many projects will begin in the immediate future. The apportionment is shown in the tabulation.

ALLOCATION OF FEDERAL HIGHWAY FUNDS

State	Highways, roads, and streets	Elimination of grade crossings	Total
Alabama	$4,151,115	$4,034,617	$8,185,732
Arizona	2,569,841	1,256,099	3,825,940
Arkansas	3,352,061	3,574,060	6,926,121
California	7,747,928	7,486,362	15,234,290
Colorado	3,395,263	2,631,567	6,026,830
Connecticut	1,418,709	1,712,684	3,131,393
Delaware	900,310	418,239	1,318,549
Florida	2,597,144	2,827,883	5,425,027
Georgia	4,988,967	4,895,949	9,884,916
Idaho	2,222,747	1,674,479	3,897,226
Illinois	8,694,009	10,307,184	19,001,193
Indiana	4,941,255	5,111,096	10,052,351
Iowa	4,991,664	5,600,679	10,592,343
Kansas	4,994,975	5,246,258	10,241,233
Kentucky	3,726,271	3,672,387	7,398,658
Louisiana	2,890,429	3,213,467	6,103,896
Maine	1,676,799	1,426,861	3,103,660
Maryland	1,750,738	2,061,751	3,812,489
Massachusetts	3,262,885	4,210,833	7,473,718
Michigan	6,301,414	6,765,197	13,066,611
Minnesota	5,277,145	5,395,441	10,672,586
Mississippi	3,457,552	3,241,475	6,699,027
Missouri	6,012,652	6,142,153	12,154,805
Montana	3,676,416	2,722,327	6,398,743
Nebraska	3,870,739	3,556,441	7,427,180
Nevada	2,243,074	887,260	3,130,334
New Hampshire	945,225	822,484	1,767,709
New Jersey	3,129,805	3,983,826	7,113,631
New Mexico	2,871,397	1,725,286	4,596,683
New York	11,046,377	13,577,189	24,623,566
North Carolina	4,720,173	4,823,958	9,544,131
North Dakota	2,867,245	3,207,473	6,074,718
Ohio	7,670,815	8,439,897	16,110,712
Oklahoma	4,580,670	5,004,711	9,585,381
Oregon	3,038,642	2,334,204	5,372,846
Pennsylvania	9,347,797	11,483,613	20,831,410
Rhode Island	989,208	699,691	1,688,899
South Carolina	2,702,012	3,059,956	5,761,968
South Dakota	2,976,454	3,249,086	6,225,540
Tennessee	4,192,460	3,903,979	8,096,439
Texas	11,989,350	10,855,982	22,845,332
Utah	2,067,154	1,230,763	3,297,917
Vermont	924,306	729,857	1,654,163
Virginia	3,652,667	3,774,287	7,426,954
Washington	3,026,161	3,095,041	6,121,202
West Virginia	2,231,412	2,677,937	4,909,349
Wisconsin	4,823,884	5,022,683	9,846,567
Wyoming	2,219,155	1,360,841	3,579,996
District of Columbia	949,496	410,804	1,360,300
Hawaii	926,033	453,703	1,379,736
Engineering & Administrative Reserve	5,000,000	4,000,000	9,000,000
Totals	$200,000,000	$200,000,000	$400,000,000

Building 1,300 Modern Homes

MARKED progress in its nation-wide housing program, calling for the construction of 1,300 modern homes by September 1, was announced on June 10 by the General Electric Company, with the release of definite figures on building projects which are actually under way in some of the country's larger cities. Under this home-building program, committees have been formed in communities throughout the United States, composed of dealers, public utility representatives, and builders, for the purpose of constructing one house for each hundred thousand of population. Many of the houses were begun about June 15, taking added impetus from the support of the Federal Housing Administration, which launched a nation-wide home-building movement on that date.

Cement Industry Looking Brighter

"Gradual improvement in the position of principal consumers of cement is taking place," says Moody's. The industry's outlook is favored, according to the survey, by improvement in farm income, increased residential building and projected road construction under the government relief program.—*Denver, Colo., News.*

Show Value of Welded Wire Fabric as Slab Reinforcement

Tests at University of Delaware Disclose Facts of Major Importance in Reinforced Concrete Design†

By T. D. MYLREA
Professor of Civil Engineering, University of Delaware, Newark, Del.

IN the discussions of the building code committee of the American Concrete Institute several questions were raised as to the properties of cold-drawn electrically-welded wire fabric and its action when used as a reinforcing material in reinforced concrete slabs. It was decided to conduct a series of tests in order to shed light on these points. The specific questions to which attention was directed were as follows:

First, what is the effect of spot-welding upon the strength of the wire strands?

Second, is it permissible to droop the material from the top of the slab in a region of negative moment to the bottom of the slab in a region of positive moment, instead of bending it sharply at the point of inflection or carrying a portion of the positive reinforcement straight through into the supports without bending?

Third, what is the permissible unit tensile stress in cold-drawn steel wire used as a reinforcing material?

Fourth, does the concrete incasement of the structural steel supporting members influence the effective length of the span?

Preliminary Tests

The effect of the welding process was first studied by making tension tests on a number of pieces of the wire it was proposed to use as a reinforcing material—i. e., wires of No. 3 and No. 9 W. and M. gauge. Fifty specimens of each gauge were so tested as to include one cross wire in the length under test, and for purposes of comparison, fifty more specimens of each gauge were tested between welds.

The No. 9 wires yielded the following results:

	Breaking strength, lb. per sq. in.		Distance of break from weld, in inches
	Between Welds	Through Welds	
Highest	71,100	71,400	5
Lowest	65,200	64,400	¼
Average of 50 specimens	67,600	67,900	1¾

The results of the tests on the No. 3 wire are as follows:

	Breaking strength, lb. per sq. in.		Distance of break from weld, in inches
	Between Welds	Through Welds	
Highest	83,000	91,000	7 5/16
Lowest	75,100	75,400	½
Average of 50 specimens	78,400	78,100	3⅛

In both tables it will be observed that the strength of the wire apparently was not affected by the cross welding; and in no case did the wire break in the weld. Both sizes of wire complied fully with the A. S. T. M. specifications, except that the strength of the No. 9 wire was slightly below the required 70,000 p.s.i.

Fourteen Test Slabs

The effectiveness of the wire fabric as a reinforcing material and the influence of its positioning upon the strength of the reinforced slabs was then investigated by studying the behavior of fourteen 4-in. test slabs. The slabs were cast, indoors, in three groups beginning on October 11, 1934, and the dates of casting were so spaced as to give all slabs approximately equal time — 28 days—for curing. Broken stone coarse aggregate of ¾-in. size was used, and special care was taken to obtain the same proportions in each casting. All slabs were covered with burlap which was kept moist for one week. Test cylinders showed that the strength of the concrete at 28 days was between 2,100 and 2,400 p.s.i.

In order that the effect of length might be brought out, the supports for slabs number 1 to 7 were spaced 5 ft. apart, and for slabs number 8 to 14 the supports were on 8-ft. centers. It was desired also to investigate the effect on the slab of end restraint varying from complete freedom to complete fixation. Hence, in each span two slabs were simply supported, one was cantilevered over one support, and 4 were cantilevered over both supports. Of these double cantilever groups the supporting steel beams of one slab of each span length were incased in concrete, as is usual in building practice.

The reinforcement was designed in accordance with the proposed New York building code, to carry a uniformly distributed live load of 150 lb. per sq. ft. The most convenient commercial fabric having the required cross sectional area contained No. 9 longitudinal wires at 4-in. centers with No. 12 transverse wires at 12-in. centers for the 5-ft. spans, and No. 3 longitudinal wires at 4-in. centers, with No. 8 transverse wires at 16-in. centers for the 8-ft. spans.

Types of Loading

Although the slabs were designed for a uniform load it was deemed advisable to test them under concentrated loading, simulating as nearly as possible the moments and shears produced by uniform loading, in order to preclude the indeterminate arching effect of an applied uniform load. On the simply supported spans, therefore, the concentrated loads were applied at the outer quarter points of the span. In this position the shears produced are the same as those resulting from a uniform load giving the same bending moment. On the slabs having the double overhang the loads were so placed as to produce a maximum negative moment equal to twice the maximum positive moment—a condition which corresponds to complete fixation under uniform load—and so placed that the points of contraflexure would coincide with those produced by a uniform load. On the slabs having a cantilever at one end only, the position of the loads was such as to produce equal positive and negative maximum moments, this being an intermediate state between simple support and complete fixation.

Where Failure Occurred

In all cases failure occurred by the breaking of the longitudinal wires at the point of maximum moment and in no case did any wire break in the weld. These facts are particularly significant when it is remembered that a crack always occurred at a point of maximum moment, and also at this point a cross wire was always present. Thus for the longitudinal wire to break at a point away from the weld, it actually had to break away from the crack and pull out of the sound concrete.

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†Author's abstract of more complete report dated April 25, 1935, and entitled *Concrete Slabs Reinforced with Welded Wire Fabric.*

The behavior of the 5-ft. spans showed very clearly the influence of the strength of the concrete itself, a factor neglected in design. In the simple spans of this length only one crack formed, and the longitudinal reinforcement broke either at the load which caused the crack or when an attempt was made to apply the next increment of load.

The same phenomenon was observed in the behavior of the 8-ft. span, though not in so marked a degree; for here, because of the larger percentage of steel employed, the loads carried were much in excess of those which caused the first cracks, and hence resulted in the formation of more than one crack in each slab. In general more cracks occurred in the slab with drooped reinforcement than in the others, although the difference is not pronounced except in the case of the simple spans. This phenomenon may be explained by the fact that as the applied moment decreased away from mid span, so also did the depth to the reinforcing steel.

The manner in which the slab cracked has an important bearing on the permissibility of drooping the reinforcement. It is evident that the resistance of concrete to tension, although neglected in design, insures the integrity of the concrete for some distance on each side of the point of contraflexure. It is in this region that the reinforcement is drooped; and hence as ordinarily constructed the reinforcement may be counted upon as being present in all regions of tension where there is danger of cracking.

Results of Tests

Concerning the amount of reinforcement employed, it will be noticed that even in the slabs containing the most reinforcement the percentage of steel present was not much more than half the amount required when steel of structural grade is used.

It is of interest to note that slab No. 2 was apparently stronger than slab No. 1, and that the strength of slab No. 9 bore practically the same ratio to the strength of slab No. 8. Slabs No. 2 and No. 9 were reinforced with drooped steel. No special reason for this phenomenon is apparent, but it is evident that drooping the reinforcement does not impair the strength of the slab, and that up to at least 8 ft. the variation in span length produces no detrimental effect. Similarly, comparing the stresses developed in slabs No. 4, 5, and 6, it is seen again that the slab with the drooped reinforcement, No. 6, is in no wise inferior in strength to the other two. Comparing slabs No. 11, 12, and 13, slab No. 12, with separate sheets of reinforcement, developed a somewhat greater strength than the other two, but the slab with the drooped reinforcement was stronger than that in which the reinforcement was bent sharply at the points of inflection. Slabs No. 7 and No. 14, compared with the others of similar span, indicate quite forcibly the strengthening effect of the concrete haunches, and show that it is quite reasonable to base the bending moment upon the clear spans.

The question might be raised with respect to the 5-ft. spans as to the adequacy of the reinforcement. The amount used was, as stated before, just about the percentage required to make the reinforced slab equal in strength to the unreinforced slab. Moreover, the average live load required to cause the first crack in these slabs, and incidentally to bring about the failure of the steel, was equivalent to 630 lb. per sq. ft. From this it will be seen that the slab, even with this small reinforcement, had a factor of safety of 6.3.

Summary

This series of tests demonstrates effectively that:

First: Cold-drawn wire which has no definite yield point may be expected to develop its full ultimate strength in a reinforced concrete slab; and therefore a working stress of 50 per cent of the elastic limit as defined by the A. S. T. M. specifications is quite permissible.

Second: Electrical welding of the intersections does not necessarily produce a fabric with a lower tensile strength than that of the individual wires.

Third: Drooping of the reinforcement is quite as effective a method of reinforcing a slab as placing it in any other position.

Fourth: It is quite permissible to use the clear spans in computing the bending moments.

Gets Log-Cabin Effect with Concrete Units

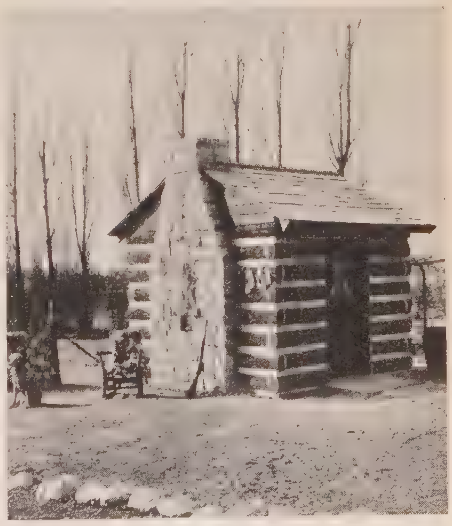
How Walls Are Built—Size and Shape of Units

A RUSTIC log-cabin effect, with the advantages of fireproof wall construction, is obtained in a "cabin" built of haydite concrete building units at 105 S. Denny Street, Indianapolis, by H. W. Linaburry, superintendent of the Spickelmeier Fuel and Supply Co., of that city. The structure is shown.

The appearance of logs is obtained with haydite concrete units 8 in. high and 4 in. in thickness on the upper and lower mortar faces. The exposed face is "crowned," or curved out, to an amount of $1\frac{1}{2}$ in., bringing the over-all thickness of the unit to a total of $5\frac{1}{2}$ in. at the midpoint. Special corner units are made with one end "crowned" in a manner similar to the exposed side.

The effect of mortar between "logs" was obtained with a course of bricks, which were pointed up and coated with a thin layer of mortar, the mortar having been roughened with a rake that was drawn across it in a zig-zag fashion.

In the building here illustrated the "log" units were backed up with standard concrete masonry units, which were furred and plastered on the inside. It would be possible, of course, to use this veneer of "logs" on wooden stud construction, although complete fire-safety can be obtained only by means of masonry back-up and the the placing of a concrete floor.



Log-cabin effect obtained with concrete masonry units

Ready-Mixed Concrete Must Hold Its Gains

By H. F. THOMSON
Vice-President, General Material Co., St. Louis, Mo.
President, National Ready-Mixed Concrete Association

One of the most energetic workers in the long struggle to bring the producers of ready-mixed concrete into a trade association of national scope is H. F. Thomson, vice-president of the General Material Company, of St. Louis, and president of the National Ready-Mixed Concrete Association.

Because of Mr. Thomson's broad experience in the production of ready-mixed concrete, and his familiarity with the operation of this industry under the NRA Code, the Editor of "Concrete" requested him to express his views on the industry's "next move"—a step that must be taken if the benefits of the code are to be retained.

In this article Mr. Thomson points the way. Let us hope the ready-mixed concrete industry follows the direction he has indicated. —Editor.

LIKE all other factors associated with the construction industry, the suspension of the NRA codes has left the ready-mixed concrete group in a somewhat confused state. But considered broadly, the noble experiment of the codes may be thought of as having benefited our own and related industries, and hence our immediate problem is that of retaining such gains for our individual welfare as have been attained.

To many of us the idea of regimentation under government domination, as represented by the NRA set-up, was at first revolting as un-American. But still, beyond the reform ideas of a social nature—such as arbitrary requirements regarding hours, wages and child labor—there was a fundamental intention in the NIRA legislation of aiding business to recover. Aid toward recovery was sorely needed by members of the ready-mixed concrete industry, along with other factors in the durable-goods field. And so our industry conscientiously supported the code idea, in the hope of stabilizing our market, and of relieving us of the incubus of irresponsible practices whether by other producers of ready-mixed concrete or by members of related industries.

The results of code administration were admittedly short of some of the roseate expectations which were voiced. But as we now look back, we realize that the wage and hour provisions were for most of our members not unduly burdensome, but that on the other hand the operation of the fair-trade-practice provisions did result in stabilizing markets to a degree not before accomplished, which meant a surer margin of return between costs and selling prices. As there will always be a hair-trigger control on the price of ready-mixed concrete due to the competition from other methods of handling materials, our market prices could nowhere become unduly high. Definite knowledge of competitive factors was of itself stabilizing and gave us better average returns.

With the withdrawal of code restraint, such as it was, ready-mixed concrete operators, like other groups, must turn to their trade association for aid in continuing the degree of stabilization and improvement so far attained. In general, there will now be a greater dependence on trade associations than ever before for functions such as collection of statistics, guidance as to good trade and technical fair practices, contacts with government agencies, as well as promotion of each industry in competition with others. There are two factors which make particularly difficult the functioning of an association on behalf of ready-mixed concrete operators; first, as the preponderance of our operations are distinctly intra-state, we can not expect aid from trade practice conferences sponsored by the Federal Trade Commission, which will be beneficial to many industries having distinctly inter-state distribution; and second, the varied relationship with other industries of those engaged in ready-mixed concrete make it hard for us to realize a distinct "industry consciousness." But still, most of the problems of those who have invested in the ready-mixed concrete field are common problems, regardless of other relationships, and hence we need a strong trade association, representative of the entire industry, for our mutual aid and guidance.

So at this state, a primary concern of everyone in the ready-mixed concrete field should be a continuance of the spirit of co-operation and fair practice which has been developed during the code experience. And a successive interest should be full participation by every operator in the program of voluntary development which may be expected to be outlined by our trade association as rapidly as the crystallization of thought by the industry's leaders will permit.

In this connection it is worth mentioning that the directors of the National Ready-Mixed Concrete Association will hold a meeting at the Palmer House, in Chicago, on July 1, to consider a comprehensive association program.

Contractors Like Code Principles

SIMULTANEOUSLY with an official notification to nearly 40,000 general contractors of the nation by the Divisional Code Authority for General Contractors, Inc., of its discontinuance in view of the recent Supreme Court decision invalidating NRA codes, the Associated General Contractors of America—national trade association of the general contracting industry—has issued a call to every general contractor of record to get behind a concerted movement to support voluntarily the principles of the code of fair competition under which they have been operating for the past 14 months.

While addressing their appeal directly to the general contractors themselves, officials of the association made it clear that they will look to public co-operation for enforcement of the voluntary code through ostracism of "chiselers."

The executive committee of the association has found indisputable evidence of industry-consciousness on the part of general contractors under the compulsory code. The industry is capable of a larger measure of self-regulation than it has practiced in the past.

◆ EDITORIAL ◆

The Successors to the Codes

One of the most widely discussed topics since the Supreme Court handed down its decision invalidating NRA codes is centered around the possibilities of group action on a voluntary basis. Letters and articles printed in this issue of CONCRETE disclose an almost unanimous belief in the need for carrying on the work that was started under the codes.

Now that the codes are gone, leaders of industry are finding themselves cast adrift without an oar. In many cases the very men who were most antagonistic to the NRA—or thought they were—now realize their helpless position. They realize how a few shortsighted and selfishly stupid individuals in any industrial group may plunge the entire industry into ruinous competition—a competition that knows no law except the law of the jungle.

Pleas are going out through the press, urging manufacturers, contractors, and employers of all sorts, to maintain the wage and hour schedules of the former codes of fair competition. Undoubtedly, these pleas are having a good psychological effect—for a time; but no one expects purely voluntary action to suffice for any length of time. Even now the chiseler is getting in his work.

In consequence, it is to be hoped that no group in the concrete construction industry will allow itself to be lulled to sleep with the thought that voluntary action will serve the purpose—unless that voluntary action takes the form of co-operative action backed up by individual contracts.

Some of the branches of the concrete construction industry—particularly the manufacturers or producers of construction materials—may find in Appalachian Coals, Incorporated, the answer to the problem of fair competition and co-operative marketing. This organization is built around definite contracts—there are contracts between individual coal mining companies and Appalachian Coals, authorizing the latter to act as "agent" in the sale of the output. Production is controlled, the price structure is maintained, and sales are allocated to the co-operating companies. And above all, this organization has won the sanction of the Supreme Court.

Co-operative marketing groups of the Appalachian Coals type can expect to succeed, under proper management, for the simple reason that there is something substantial back of it—and that *something* is a definite contractual obligation.

Residential Construction Is Spreading

The most encouraging construction report in 43 months was issued on June 25 by the F. W. Dodge Corporation, statisticians.

"It begins to look as if the long-expected revival of residential construction had definitely arrived," says the report. "New residential building projects started during the month of May reached the largest dollar total that had been seen in 43 months.

"The encouraging feature of this year's sustained rise in residential construction," the Dodge report continues, "is found in the fact that it has consisted almost entirely of private new construction."

The concrete products industry is perhaps in the most favorable position, of all the concrete construction groups, to profit from this constantly increasing volume of residential construction. In fact, the products industry actually has begun to reflect this increased activity. But as in all other cases, direct benefit to one group gives prompt stimulus to others. Cement, aggregates, mineral colors, new machinery and repair parts—all these must be bought by the products man.

Other concrete construction groups that are gaining direct benefit from the increased volume of residential and other private construction include the ready-mixed concrete producers, the concrete pipe manufacturers, the concrete forms people, the manufacturers of concrete mixers and conveying equipment, and others.

This is, in truth, the most encouraging report in 43 months!

A. S. T. M. in Thirty-Eighth Assembly

The American Society for Testing Materials is holding its thirty-eighth annual meeting in Detroit, in the last week in June.

The sessions on cement and concrete, as indicated in the summary of that part of the program appearing on page 18 of our June issue, will hear a number of papers and reports on a wide range of subjects.

Committee C-1 on Cement will probably carry off the honors, in view of the great quantity of work accomplished by this group during the past year. Committee C-9 on Concrete and Concrete Aggregates follows closely on its heels. Committee C-13 on Concrete Pipe, likewise, has had an active year and is presenting several new or revised specifications.

The concrete construction industry should be grateful to the members of these committees for the excellent work accomplished.

PROGRESS—In a Page

◀ **Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.** ▶

Influence of Size of Cement Particles

DATA obtained on the effect of the granulometric composition of cement on the properties of pastes, mortars, and concretes, are reported by J. Arthur Swenson, L. A. Wagner, and George L. Pigman, in the April (1935) issue of the *Journal of Research* of the National Bureau of Standards, Washington, D. C. The report is published as *Research Paper RP-*777.

Tests were conducted on five laboratory-ground cement clinkers and one commercial portland cement. Each of the laboratory-ground clinkers was separated into five sizes, ranging from 0 to 7, 7 to 22, 22 to 35, and 35 to 55 microns, and all sizes above 55 microns. The commercial cement was separated into the first four sizes just mentioned. Tests were made on the individual fractions as well as on four cements prepared by blending the fractions in various proportions. The specific surfaces of these blended cements ranged from 1,350 to 3,300 cm^2/g. It was found that the 0-7 micron material is very valuable because of the plastic qualities which it confers upon the concrete mixes and also because of the high contribution which it makes to the early strength. The other four fractions were found lacking in plasticity and the ability to hold water, and the rate of strength development decreased with increasing grain size. The contribution of the 0-7 micron fraction to the strengths of the blended cements was calculated by an algebraic method based on the assumption that the contribution of any fraction to the strength of a blended cement is equal to the product of the decimal part of the blend composed of that fraction and the strength of the fraction when tested by itself. The values thus calculated were found to be of the order which might be expected. The analysis of all the strength data tended to prove that the compressive strength of concrete is very nearly a direct function of the amount of cement which has reacted with water. When the strengths were plotted against specific surface, one line was obtained for the blended cements and another line for the individual fractions. When these same strengths were plotted against quantities which should at least be approximations of the amount of hydrous material, all of them fell on one line.

High-Early-Strength Cement

THE sponsoring committee on High-Early-Strength Cements (M. A. Swayze, chairman), of the American Society for Testing Materials, has been carrying out an investigation of all the cements (totaling 33) of that type now available in our markets. Four laboratories have co-operated in the work, in which special features were the determination of the fineness by the No. 325 sieve and the specific surface by the Wagner turbidimeter or hydrometer, the making and testing of the usual standard sand briquets, plastic mortar cubes according to the new A. S. T. M. *Tentative Method of Test for Compressive Strength of Portland Cement Mortars* (C 109-34 T), and 6 by 12-in. concrete cylinders. The purpose of this study was primarily to compare the results of the mortar cubes with briquets and concrete, as there has been evidenced a considerable demand for a compression test specimen of mortar rather than the commonly-used tension specimen.

The committee at its spring meeting, after giving consideration to the present status of the *Tentative Specifications for High-Early-Strength Portland Cement* (C 74-30 T), voted to submit to letter ballot the question of recommending their adoption as standard, with but one revision, deleting the fineness requirements. The results of this letter ballot were favorable. The committee, therefore, recommended that with this revision these tentative specifications be submitted to the Society for adoption as standard.

Although these specifications cover only high-early-strength cements of the true portland type, the committee has not lost sight of those high-early-strength cements which are mixtures of portland cement and small quantities of other materials. It is believed that within a short time specifications will be available covering these.

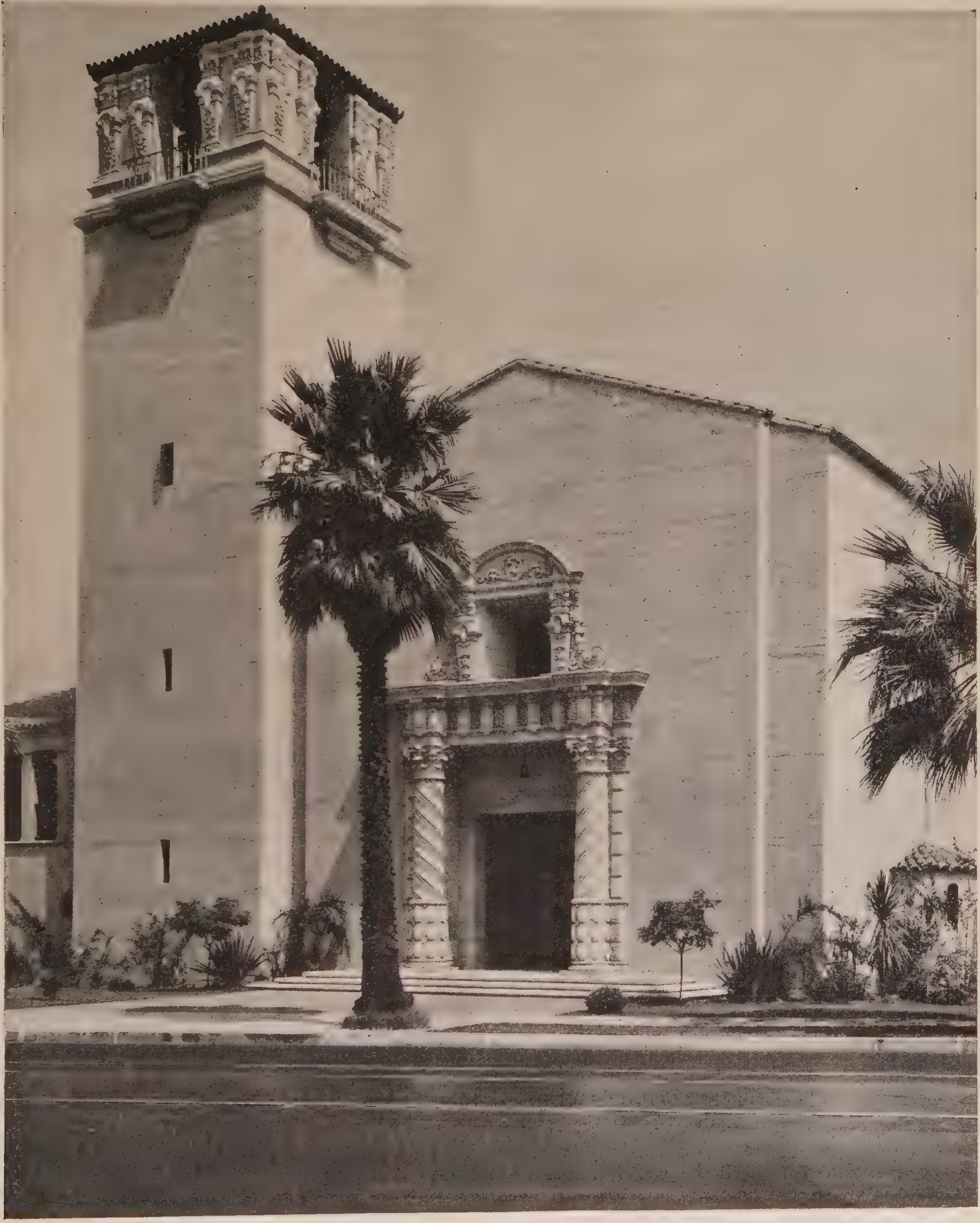
Correlating Committee on Building Codes

IN a new effort to bring some sort of order out of the chaotic situation with respect to city building codes—due in part to obsolete or inadequate provisions—the American Standards Association, 29 West 39th Street, New York, has taken steps to organize a building code correlating committee. The formation of this committee was officially approved by the A. S. A. on April 25. The following organizations have been proposed as representing groups that should hold membership in the committee:

American Institute of Architects.
American Municipal Association.
American Public Health Association.
American Society of Civil Engineers.
American Society for Testing Materials.
Associated Factory Mutual Fire Insurance Companies.
Associated General Contractors of America.
Building Officials Conference of America.
Federal Housing Administration.
Forest Products Laboratory, U. S. Department of Agriculture.
International Association of Government Labor Officials.
National Association of Builders' Exchanges.
National Association of Building Owners and Managers.
National Association of Real Estate Boards.
National Board of Fire Underwriters.
National Bureau of Standards.
National Fire Protection Association.
National Safety Council.
Pacific Coast Building Officials Conference.
Supervising Architect's Office, U. S. Treasury Department.
U. S. Public Health Service.
Members-at-large.

Additional organizations will be invited to become affiliated with the committee. In this program the National Bureau of Standards is co-operating closely, and it will carry special responsibilities in connection with important phases of the work.

Architectural Concrete



Harold Cross, *Architect*

Subdued form marks on the large wall areas of the Arlington Avenue Christian Church in Los Angeles provide a distinctive texture to these broad surfaces of monolithic concrete. The decorative entrance and tower details were cast in place in waste molds. Harold Cross, architect

A. S. T. M. Cement Committee Has Active Year

The American Society for Testing Materials is holding its thirty-eighth annual meeting in Detroit as this issue of "Concrete" is going to press. A synopsis of the part of the program dealing with cement and concrete appears on page 18 of the June issue of "Concrete."

Among the reports presented by the more active committees, that of Committee C-1 on Cement is outstanding. It discloses the numerous directions in which this well-organized group has been operating.

The ground covered by Committee C-1 is here presented. Other reports and papers presented at the current A. S. T. M. meeting will appear, either in full or in part, in later issues of "Concrete."—Editor.

THE results of the year's activities of the American Society for Testing Materials Committee C-1 on Cement can be best evaluated from the fact that it has submitted for action by Committee E-10 on Standards one proposed tentative specification and three tentative methods of test. It has further continued active work along other lines which should lead shortly to the promulgation of standards. This work has been confined to test requirements and methods for high-early-strength cements, short methods for the determination of the magnesia in cements, methods for indicating volume changes during hardening, and the continuation of the services of the Cement Reference Laboratory in calibrating testing equipment and in demonstrating to laboratory operators the proper procedure to be used in carrying out cement testing according to A. S. T. M. Standards.

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Masonry Cement

The sponsoring committee on masonry cement (H. D. Baylor, chairman) has given consideration to the *Tentative Specifications and Tests for Masonry Cement* (*C91–32 T*) for which it is responsible. Notwithstanding the great interest by various groups in masonry cements, the committee has not received much in the way of comments as a result of promulgating these tentative specifications. It consequently addressed a questionnaire to all those known manufacturers of this commodity, asking among other things, their attitude towards withdrawing these tentative specifications or continuing them "as is," pending further study, or revising them along lines which they were to suggest in replying to the questionnaire. Unfortunately, no very constructive suggestions were received regarding the nature of future studies, but it was very evident that the manufacturers did not desire to have the tentative standard withdrawn. Hence, the committee is recommending that *Specifications C 91–32 T* be continued as tentative for another year.

Chemical Analysis

Although the working committee on methods of chemical analysis (W. C. Hanna, chairman) completed during the year the preparation of the recently issued *Tentative Method of Chemical Analysis of Portland Cement* (*C 114–34 T*),[1] it has actively continued its work. Where specifications do not require a complete chemical analysis but place limits upon the amount of magnesia allowable, it is very desirable that a shorter method be available than that contained in the present *Standard Methods of Sampling and Testing Portland Cement* (*C 77–32*). The working committee has conducted a comparative investigation in a group of laboratories covering several quick methods and the present *Tentative Method C 114–34 T*. The results indicate that possibly two of the shorter methods may be adequate. They appear both precise and accurate, as may be noted in the report appended hereto, wherein are presented briefly the results of this investigation. However, the committee is not ready at this time to make any recommendations and is now conducting a second co-operative study with two cements, with 24 laboratories participating.

It has also inaugurated work covering the determination of manganese oxide and ferrous oxide in cements. The presence of these oxides in any quantity very materially affects the calculations of the amounts of the four major compounds assumed to be present in portland cement.

Low-Heat and Blended Cements

It is with much regret that the committee cannot announce more than progress in its work on low-heat and blended cements. While it is true that the agitation regarding true low-heat cements has somewhat subsided, the opposite is the case with blended cements. It is believed, however, that during the coming year something more than progress will be achieved in these two activities.

Volume Change and Soundness

The working commmittee on volume change and soundness of portland cement (H. F. Gonnerman, chairman) which has been assigned these problems has not lost sight of the importance of further work toward developing better methods to determine volume change and soundness. But while it seems that the early disintegration of cement products or test specimens, due to inadequate manufacturing procedure, has become a thing of the past and the test method has become almost unnecessary, there remains much concern over the change in volume due to hardening and to cycles of wetting and drying. What work has so far been carried out by the working committee has not yet yielded results which might be used as a basis for developing an acceptance test. The question is being actively studied.

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[1] Published in separate pamphlet form.

Plasticity

The working committee on plasticity (C. H. Scholer, chairman) has given some thought to the possibility of applying certain procedures used at the National Bureau of Standards in its study of masonry cements as a method for evaluating the relative plasticity of cements. This method involves a change in working qualities of mortars after being subjected to the withdrawal of water by an absorptive base. A questionnaire was distributed to a number of laboratories studying this property and elicited some interesting comments, but did not lead to any information which might be used in developing a test program.

Cement Reference Laboratory

A brief of the activities of this laboratory, maintained at the National Bureau of Standards by the committee, is appended. Of more particular interest is a tabulation showing the results of the calibration of equipment on the several inspection tours, which now total four. This shows the value of this work most concisely and conclusively and it further shows the spirit in which the public has accepted the efforts of the committee. Such a marked increase in acceptable equipment has been brought about only by the ready and prompt acquiescence of those maintaining testing laboratories in the inspection results. The suggested replacement or readjustment of faulty equipment has in many cases entailed an expenditure of considerable funds, but it seems that those who have made such expenditures have been very highly pleased with the improvement in their laboratories. With the adoption of some of the new tentative methods, such as those involving compression specimens, the work of the cement reference laboratory will have to be expanded to take care of the equipment used in such testing. This is being considered by the subcommittee concerned with this activity.

New Tentative Standards

During the year Committee C-1 presented to the Society, through Committee E-10 on Standards, four proposed standards for publication as tentative. Two of these, the *Tentative Method of Chemical Analysis of Portland Cement (C 114–34 T)*, and *Tentative Method of Test for Fineness of Portland Cement by Means of the Turbidimeter (C 115–34 T)*, were formally accepted by Committee E-10 and have now been issued as tentative. Approval of the other two proposed standards, namely, *Specifications for Sulfate-Resistant Portland Cement*, and *Methods for Sampling and Testing Sulfate-Resistant Portland Cement*, was withheld pending the receipt of more supporting data. These are being given further thought by Committee C-1. The *Tentative Methods C 114–34 T* and *C 115–34 T* have been published so recently that no comments have been received; consequently it was recommended that they be continued as tentative for the coming year.

Plastic Mortar

It was also recommended that the *Tentative Method of Test for Compressive Strength of Portland Cement Mortars (C 109–34 T)*, remain as tentative for another year. This method is being used not only for further study by the committee, but is also being used in purchase specifications in several large concreting operations; among others, by the Tennessee Valley Authority in a recent purchase of 6,500,000 barrels of cement and in the purchase of 1,200,000 barrels by the United States Engineer Office for the Tygart River Reservoir Dam. Several laboratories are co-operating also in studying such questions as the effect on the strength of variation in the grading of the sand, of using a variable instead of a fixed amount of water, of using non-sealed instead of sealed molds, speed of testing, etc. Valuable information should soon be available which will be of use to the committee in considering the adoption of this method as standard.

A Book of Housing Plans

Housing Division of PWA Issues Huge Volume of Large-Scale Plans for Slum Clearance

UNIT PLANS is the title of a large book of several hundred pages, 10½ by 14-in. page size, issued by the Housing Division of the Public Works Administration, Interior Building, Washington, D. C. Horace B. Hackett is director of housing.

The purpose of this excellent volume, bound in loose-leaf style, is that of presenting architects and structural engineers with typical guide plans in various forms of large-scale housing.

Basic features of low-rent housing, types of unit plans, and housing standards, comprise the subject-matter of the first part.

Part II covers typical unit plans, including apartments, row houses, flat houses, and combination flats and row houses.

Part III shows numerous site plans, or layouts, for a great variety of shapes and sizes of ground areas.

Numerous construction details and architectural designs are shown in another part, and a final part sets forth errors to be avoided.

Every architect or structural engineer who contemplates work of this nature should obtain a copy of this book.

Residential Construction Continues Gains

"Residential building volume has already exceeded expectations for the half year," says a *Brookmire* report dated June 19. "The freedom with which mortgage money is becoming available augurs well for further improvement. These facts create purchasing power and indicate good trade."

The Universal Concrete Pipe Company with plants at Sandusky, Ohio, and at Buffalo has taken space in the former Globe Malleable Iron Company plant at Syracuse, N. Y., and will employ 25 men.

Build Experimental Homes at Purdue University

Laboratory to Test Effect of Severe Weather Is Part of Low-Cost House Project

IN an attempt to solve problems of better living and better homes at lower costs, science and industry joined hands in the National Homes Conference held at Purdue University on June 1. Nearly 100 persons, including those concerned with supplying of heavy materials for home building, architectural designers, financiers and others concerned with this industry, met at the university upon invitation of the Purdue Research Foundation to discuss this matter of better homes.

Owen D. Young, chairman of the board of the General Electric Company; President E. C. Elliott, of Purdue; Mrs. William Brown Meloney, Sunday editor of the New York *Herald-Tribune* and editor of *This Week* and an official of the Better Homes Bureau in New York; and David E. Ross, president of the university board of trustees, were the speakers.

At the opening of the meeting it was announced that the Research Foundation had plans under way for building a group of 10 to 20 moderately priced homes this year on a tract of 143 acres near the campus. These homes will represent the last word in convenience and construction in a small home, the kind the average man can afford to buy or build. Some of the best home planners in America are being consulted in the planning and designing of these homes, and also in the layout of the entire community. These homes will provide a living laboratory for the study of better living conditions for the average family, which represents the large consuming group for new homes.

The homes which will be built by the Foundation for persons in the $2,000 to $2,400 salary group will be used for complete studies of heating, ventilating, lighting, air conditioning, insulating, and other essentials of the home. Also a thorough study will be made of the materials to be used in house construction, and the various kinds of materials now on the market will be thoroughly tried out.

It was also announced at the conference that an "all-weather laboratory" will be built on the Purdue Research Foundation's homes campus. This structure, which will be large enough to hold an entire house, will be used to reproduce all kinds of weather, so that in the course of a few months a house may experience the weather it would usually encounter in a course of 20 years or more in the temperate zone. Zero weather, rain, snow, freezing and thawing, and all the other pranks in the bag of the weatherman will be produced at will in this laboratory, and the effects will be studied. The data will be made available to the entire building industry as well as to the ultimate consumer, the man who buys or builds the house.

G. Stanley Meikle, director of research relations with industry for Purdue University, located at Lafayette, Indiana, is in active charge of the project.

Highway Group to Conduct Abrasion Tests of Aggregate

THE Deval abrasion test, which was originally devised for use with rock for water-bound macadam, has been used extensively for testing aggregates for portland cement concrete and bituminous pavements and bases, in spite of the fact that the test has never been shown to have any direct relation to the characteristics and behaviors of the road surfaces. It is simply an identification test. Undoubtedly it has some utility for comparing rocks from different quarries and different strata in the same quarry, and the products of different gravel pits, but it has never been found satisfactory for the routine testing of shipments. There is no general agreement as to its significance. Another principal disadvantage is the fact that different methods and test limits must be used with crushed stone, gravel and slag.

In spite of the insufficiency of the methods now in common use, most engineers feel that the resistance of aggregates tc abrasion when properly tested will bear a definite relation to their relative suitability for use in road construction. On this account the mineral aggregates committee of the Highway Research Board has organized a project for supplementing the information now available on the value of the Los Angeles rattler for determining the suitability of coarse aggregates in various types of road surfaces, for comparing results of tests in this rattler with those obtained by the standard and modified Deval abrasion tests, and for studying the correlation of Los Angeles rattler test results with service records. Some twenty college and highway department laboratories are co-operating in the work.

The U. S. Bureau of Public Roads has run an extensive series of tests with the Los Angeles rattler, and made a study of the service behavior of aggregates from about 45 different sources, which shows specially good correlation between the results of this test and road conditions.

The Los Angeles rattler test was developed by the City of Los Angeles about ten years ago and has been used as an acceptance test for coarse aggregate by the California Division of Highways since 1927. While the Deval test has never been satisfactory as a routine acceptance test, the Los Angeles method has been especially devised for that purpose; hence it has great possibilities for usefulness if the comprehensive investigation now being started demonstrates its suitability for this purpose.

The Los Angeles rattler differs from the Deval machine in that the barrel is larger and revolves on a horizontal axis, and contains a shelf extending from end to end. Cast iron blocks or balls are included with the aggregate to add the factor of impact, which is absent in the Deval test.

In this investigation it is planned to cover a wide range in aggregates in an effort to get enough data either to support or discredit the Los Angeles test as an acceptance test for aggregates. To this end it will be necessary to correlate the laboratory test results with the service records of the materials tested.—R. W. Crum, in *Highway Research Abstracts*, June, 1935.

The Concrete Products Manufacturer

Association Activities + + + News of the Industry

THE concrete products industry, no less than numerous other industrial groups, is now "on the spot." There is a very definite meaning to the congressional extension of a modified NRA for a period of ten months, and it will be regrettable if the leaders of industry do not see the point.

What this congressional action means is that industry has ten months to prove its claims that it can operate to better advantage on a co-operative basis, without governmental "interference."

If the concrete products industry undertakes a co-operative plan, it is devoutly to be hoped that the leaders of the industry will not attempt to place it purely on a voluntary basis. Such an arrangement works only until selfishness prompts the few trouble-makers to break out of line.

In contrast, state groups (or even smaller groups) could organize central sales agencies analogous to Appalachian Coals, Inc., as pointed out in an editorial on page 13 of this issue.

Groups of that character are bound by definite contracts, and they possess, in advance, the sanction of the Supreme Court. In consequence, such organizations not only have "teeth," but they have stability.

What Is the Next Move?

Leaders of Concrete Products Industry Declare Work Started Under NRA Code Must Be Continued in Some Voluntary Form

THE Supreme Court decision invalidating NRA codes was handed down the day after the June issue of "Concrete" went to press. The editor at once communicated with some of the outstanding leaders of the concrete products industry—as well as of other groups—and invited them to express their views as to what steps this industry should take so that the work accomplished under the code would not be lost.

"Concrete" is happy to present the views of these men. In the expressions that follow, members of the products industry should find the answer to the great question of the day—"What is the next move?"—Editor.

Concrete Masonry Industry Should Now Act Through National Association

By **D. R. COLLINS**

Asst. Secretary, National Concrete Masonry Association, 33 W. Grand Ave., Chicago

This is in reply to your letter relative to the effect of the Supreme Court decision on the concrete masonry industry. While the National Concrete Masonry Association had no jurisdiction over, or part in, the administration of the code, it naturally was interested in any benefits which might result from its application.

My feeling is that most of the gains which the concrete masonry industry made under the code were psychological. The code, however, did a great good in bringing together local groups, who previous to its promulgation had done little or nothing toward working together. Provisions of the code necessitated frequent meetings of these organizations, which stimulated a friendship and spirit of camaraderie which had not existed prior to this time.

If the code did nothing but perpetuate meetings of this sort it has done much for the industry. Certainly no local or state group which advanced its spirit of co-operation because of code activities should discontinue meetings or activities because of the Supreme Court decision.

It is my belief that the industry has demonstrated that it is in a position to carry on much of the promotional work and advertising that is so necessary for the industry if it is to continue the progress of the last few years. In supporting the code, the industry has shown that when necessity arises it can rally to the financial support of any worth while movement directly affecting it. In the past it has contributed to such worth while causes as the fire tests at the Underwriters Laboratories, the wall stability tests at the University of Illinois, the publication of the book "Facts About Concrete Masonry," and a brief advertising program designed to stimulate interest in the use of its product in federal buildings.

There lies ahead much more to be done if the industry is to continue to develop and entrench its gains of the past few years. At present there are still a number of research projects which should be financed. Once these projects are completed their findings should be made available to the public, particularly to such groups as architects, realtors, bankers and others who directly influence the use of its material.

It is my hope that every member of the industry will continue to abide by the hours of labor, rates of pay and fair trade practices set up under the code. It is also my hope that it will continue its support of the National Concrete Masonry Association, which has done so many constructive things for it in the past.

The concrete masonry industry has ahead of it the greatest opportunity of any period of its life. Certainly support of a strong trade association to coordinate its activities, to fight its battles, to stimulate interest in its product, is justified at this time.

We are looking forward to a great revival in the industry's more important market—home building. Besides residence business, it is significant that during the past four years concrete masonry has been used in more high-grade construction than in any other like period. It has become an accepted material — accepted by architects, contractors, realtors and financial groups as a basic material to be written into specifications on its own merit and not as an alternate. It has made definite gains that must now be entrenched. It must prepare to move forward.

The National Concrete Masonry Association has in the past served as a focal point in directing the technical and promotional program of the industry. Manufacturers can again turn to it with confidence for counsel and guidance in the many important problems facing the industry—in the direction of its advance.

Many Outspoken Opponents of Code Now Realize Good Features Should Be Retained

By AUSTIN CRABBS
President, The Cement Products Co., Davenport, Iowa

REFERRING to the recent Supreme Court decision in connection with NRA, I was not particularly surprised at the action that was taken; but I do not believe that this whole program will be a total loss. I have always felt that things of this kind have their place in the march of progress. The decision of the Supreme Court, you will note, has already had some tendency toward clearing the air. I refer to the fact that many people who talked against the codes now seem equally outspoken in the idea that the best features should be retained.

Personally, I feel satisfied that the code has been of considerable benefit to the concrete products industry; and most certainly, I hope some way can be found to permit the members of our industry to regulate their own affairs so far as their co-operative actions do not interfere with the best interests of the general public.

My own idea from the first has been that matters such as the code would have to be popular in order to be successful. If this premise is correct, the administration of a code becomes largely a matter of education, with the question of force kept down to a minimum and employed only in extreme and flagrant cases. Furthermore I can understand that codes would not work out very well for certain lines of industry, where there is too wide a difference in quality and cost; but I believe that something in the nature of a code could be made highly beneficial in a more or less standardized industry such as ours.

I would not hazard a guess at this time as to what the future outcome of codes in general will be; but even if the matter should be dropped entirely, I still feel that the country as a whole has benefited through the emphasis that has been placed on the folly of selling below cost, on the evils of improper trade practices, and numerous other things that have resulted in unhealthy business conditions.

I would like very much to see our industry set up a fact-finding organization from which tabulated figures could be sent out showing such things as minimum and maximum selling prices, minimum and maximum costs and other data that it might seem desirable to secure. I most certainly hope we shall be able to retain the progress that was unquestionably made during the time that our code was in effect.

Cinder Unit Industry Prepared to Go Ahead—Code Was Only Part of Broad Program

By EINAR CHRISTENSEN
President, National Cinder Concrete Products Association, 122 East 42nd Street, New York

Your letter awaited my return from a three weeks' trip, during which I visited a number of cinder unit plants and had an opportunity to bring my knowledge of the industry up to date. And now that I am back—fully convinced of the survival of fitness and a rapidly increasing opportunity for the worthwhile plants—I shall be glad to answer your question.

I am primarily concerned with the cinder unit industry—the group of plants represented by our National Cinder Concrete Products Association. We have about twelve years of joint activities back of us, including pioneer years and prosperous years, and the lean-leaner-and-leanest years of recent reckoning. And the association appears to be very much alive today.

When the NRA came into being, our association joined with the Concrete Masonry Association in formulating a code of fair practice. There were quite a few differences of opinion to be ironed out between cinder units and concrete masonry in general. The former group was rather tightly knitted into its relatively small association. It insisted on retaining its identity. The result was the concrete masonry code—and I am happy to remember the way in which so many arguments were merged into joint action for the benefit of all concerned.

While subscribing 100 per cent to the code, and co-operating with unselfishness in making it work in the entire field of concrete masonry, the cinder unit group realized that the code could not accomplish what the group desired — continued co-operation among the plants. So the National Cinder Concrete Products Association began to expand its activities. While fully supporting the code, it broadened its program and made code compliance only part of it. Co-operation in improving manufacturing and sales, the establishment of new means for replacing patent control —these were developed during the significant period following our 1934 convention.

The result is that the cinder unit group is not seriously affected by the upsetting of the concrete masonry code. My inspection tour of membership plants convinces me of that. Our association activities, now leading to the publication of a *National Cinder Unit News* in addition to the *Sales and Manufacturing Service* available to all responsible makers of cinder units, remain the most important part of the program of this increasingly active group.

We shall regret the passing of a joint concrete masonry code. Of course, we have slowly but surely seen this code reduced from what we expected it to mean when we started out two years ago. The refusal by Washington of a uniform cost finding system was perhaps the most serious blow. My own personal disappointment was in the apparent ineffectiveness of our quality clause. Hours and wages remained as the items of Washington interest and support. To our industry that should not require a solemn code and a great deal of supervision. Published prices held considerable significance; until the very last we were hopeful that this part of the code would justify all the effort expended.

Do I consider the code dead as far as our industry is concerned? Speaking as an individual—and ready to change my opinion as the clouds clear away—I do. In saying that, I pay full tribute to those who brought about the code and those who worked to enforce it, for I believe that they contributed a great deal to the welfare of the industry during two critical years.

Please understand that I am writing this as an individual. It does not express the policies of the cinder unit group, for some time must elapse before those policies can be established. The fact is, however, that our group has never been dependent upon successful code enforcement. Code adherence has only been part of our program—and our program is one that can not be upset by any Supreme Court.

I have many reasons to believe in a healthy future for our National Cinder Concrete Products Association. There is the response to the program for joint activities established at our 1935 convention. There is the impression of a recent tour of representative plants that not only convinces me of a revival of business but also of the desire to continue the association work of the past. Voluntary—yes—but it does seem to pay.

It is my hope that the Concrete Masonry Association will continue its good work of the past. The cinder unit group, by nature and by its past history limited in its scope and rather closely knit in its joint promotion of manufacture and sales, will continue as before. It will expand with expanding business. The one problem is to keep this expansion safe and sane.

I do not think that our NRA Code has been in vain, and I am happy to have had the opportunity to work with wide awake members of the general industry in bringing it about and seeing it through until now. Perhaps it can be continued—I rather doubt it; but that is the opinion of one man and one that can readily be changed.

Neither the cinder unit industry, nor the general concrete masonry industry should stand or fall with the code. Our cinder unit group will continue as usual—the code helped us, but we were careful not to make it more than part of our program. It is my hope that concrete masonry in general will keep up its effort to organize, and that the code period will have been helpful in accelerating this.

If the code can be extended in usable form I am sure that the National Cinder Concrete Products Association will put its shoulder to the wheel, now as before. In the meantime, it is pushing its general association work, and meeting a most gratifying response from the makers of cinder units.

National Associations Must Continue Best Features of NRA

By BENJAMIN WILK
Manager, Standard Building Products Co.

Relpying to your letter concerning the effect of the Supreme Court decision on the concrete masonry industry, my feeling is that most manufacturers have been paying even more than the minimum wages of the NRA, and that the present increase in business as compared with 1934 precludes any possibility of a decrease in this wage scale.

Residential building during the recent months has been approximately 80 to 90 per cent above the same period of 1934, and there is every indication that this increase will continue. Our troubles were largely due to a lack of volume and profitable business. Now that there is a fair measure of activity the products manufacturers who have been able to weather the depression are not likely to be in a frame of mind to cut prices.

The NRA code certainly had a good psychological effect, particularly in the beginning. It helped to focus attention on unsatisfactory situations and called attention to the undesirability of selling below cost. It was unfortunate that the Administration was never able to put into effect its ideas about selling below cost; but the products manufacturers individually had a chance to study their own conditions and determine what cost meant to them.

According to the Supreme Court decision on the NRA, the concrete products industry is primarily an intra-state business, and can not, therefore, be governed by national laws. It would seem, therefore, that the efforts of the code to make for better conditions in the industry can best be taken care of by trade associations such as the National Concrete Masonry Association, and the National Cinder Products Association. Along this line it is interesting to call attention to the following statement made by President Sibley, of the U. S. Chamber of Commerce, at a recent convention in Detroit:

"We don't believe there are wise enough men in the United States to govern business in this way. The solution lies in the cooperative efforts of the business men themselves. *Our trade associations will be able to carry on and preserve the best things in the NRA codes.*"

Monthly News Letter

Says Industry Must Carry On, Through Trade Associations—Would Combine Forces of Related Groups

By H. W. BUSH
Executive Secretary of former Code Authority, Concrete Masonry Industry*

It is a peculiar truism in this industry, unfamiliar I assume to many, that he who dares to thrust out his neck in a gesture of friendly co-operation, must undergo the humiliating experience of having it promptly chopped off. Concrete products manufacturers have built up a peculiar philosophy through the years. It consists of the axiom, "Do unto others as if they were the ones you'd been done by." Regrettable as it may seem, and irrespective of who may suffer, *this industry must carry on.* As I mentioned in a previous issue, our code was merely a means to an end, not an end in itself. Industry has always had a common meeting ground through associations. Those who say that cooperative effort through the medium of associations is of little value, must also admit that they have put in little, if anything. You can't take out that which you don't put in.

I have been requested, as the Ex-Executive Secretary of our National Code Authority, to suggest a practical solution of the puzzle left by the abolition of codes. While I have, in the past two years, become exceedingly proficient as a statistical acrobat, I'm afraid the art of crystal-gazing is not one of my accomplishments.

Far from settling a grave national problem, the Supreme Court's decision has only accentuated it. The constitution still lives, but so do our 10,000,000 unemployed and their dependents. Most of them will have to be fed, clothed and housed in the coming years. The government will have to do that if serious trouble is to be averted. Huge funds, of necessity, will be required.

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*211 Edgemont Place, Teaneck, N. J.

The credit of our government is as yet unimpaired. However, it is not inexhaustible. It will have to levy vastly increased taxes to finance the burden. These taxes will have to be paid directly or indirectly by business men and their employees. Business, left to the mercy of cut-throat competition and chiseling trade practices, faces reduced profits, greater losses and curtailed ability to pay taxes. Employees face the same competition and lower standards of living. That means the preponderant majority of the nation's citizens.

We must, therefore, realize that the decision which settled a widely discussed legal problem has created a human and governmental one of far greater importance. Adversaries of the principles of NRA should, in their maturer judgment, agree with Wellington that "one more victory like Waterloo and we'll all be ruined."

I am of the firm belief that economic and social laws can not be confined to local and state governments exclusively. We should have learned that as a lesson of negro slavery. It isn't difficult to imagine what would happen if certain states attempted to improve labor conditions. Business would be moved to the state that permitted unbridled freedom of exploitation of labor. All states would eventually be compelled to sink to the lowest level of the worst offender.

There is no doubt but that we are faced with choosing one of two courses. Shall we sit back and do nothing, or shall we look to the voluntary co-operation of industry? If we do nothing, the problems of unemployment can not be solved. Our systems were not devised in Heaven or Nature, but in the minds of men; and men must change them. Progress has never been made otherwise.

If we depend on voluntary agreements, we are faced with the fact that it is impossible to get all employers to agree voluntarily. Without universal agreement, the honest employers could not compete against the unscrupulous and selfish element of business. It is, therefore, quite obvious that we must look to some well defined plan, embracing the entire membership of this industry, having sufficient "teeth" to deter the activities of unethical business men.

A short time ago, Will Rogers, in one of his radio broadcasts, suggested that, as everyone else seemed to have a "plan of sorts," he would propose one himself. Well, now, this isn't quite as humorous as "Will" would lead us to believe; because, if members of this industry would propose a plan, whether good, bad or indifferent, I'm sure that we would gradually discover more sound and secure ways in which to function by co-operative action.

Any plan for this industry, at least for the present, must take into consideration the co-operative effort of other industries. If we are unable to utilize the power of the Federal Government for enforcement, then the "teeth" must, of necessity, rest with those industries which have a decided interest in our own business. The problem of enforcing the strongest fair trade practice provisions possible is capable of solution in an industry made up of numerous small units. I would suggest, therefore, that all classes of concrete products combine their efforts for participation to a maximum degree in voluntary agreements, permitted under existing state and federal statutes. It is obvious that this must be initiated through associations. A national board should be created, consisting of representatives of each division of the concrete products industry and representatives of the cement and building supply industries.

The suggestion does not embrace any radical change or propose any startling new ideas. Obviously, I cannot continue in detail a more comprehensive idea of the actual working of the plan. A good many will be able to read between the lines; and I hope they will realize that any benefits can only be brought about through the orderly process of reasoning and intelligence. We have paid the price of a terrific loss in wealth and human suffering; and may we soon learn the bitterness of our stupidity.

News of the Industry

The D. E. Minton Construction & Manufacturing Company of Parsons, Kansas, is establishing a ready-mixed concrete plant, the first in Parsons, and will manufacture a number of different concrete products at the plant—silos, fence posts, tile, lawn furnishings and precast building units of all kinds.—*Parsons, Kansas, Sun.*

Formal opening of the new office building of the Marietta Concrete Corporation at Westview, Ohio, took place recently.

"Anything in Concrete" is the slogan of the company and there is an elaborate demonstration of all of the building material lines manufactured by the concern. These products have entered into the construction of the new office building which is ultra-modern in every detail. Coloroc tile, Maconco block, art trim stone, concrete joist, and Calicel insulation, are some of the products thus employed.

Midwest Concrete Products Company, Inc., has started production of concrete brick and block at a recently completed plant located at 2417 Fourth Street, Sioux City, Iowa. Paul Kaplan is in charge.

Standard Concrete Products Company has leased a tract of land in Casper, Wyoming, for the location of a plant for the manufacture of culvert, sewer and irrigation pipe—both plain and reinforced concrete—in sizes ranging from 4 to 108 in. in diameter.

W. G. Barnes of Denver, vice-president, will direct operations of the Casper plant. All of the concrete pipe manufactured will conform to the specifications of the American Society for Testing Materials.

The Osakis Concrete Products Co., Osakis, Minnesota, started operations for the summer early in June.

The factory has made a number of improvements at its plant. The company makes silos.

The company expects 1935 to be one of the best years it has ever had, according to Peter Rutten, head of the concern, who says he has orders to back up his statement.

F. P. Mattera & Son, Inc., has recently been incorporated with a capital stock of $125,000 at Wildwood, New Jersey, to manufacture concrete products.

THE FACTS IN *Nutshells* from the National Bureau of Standards' Report—"Effect of Calcium Chloride on Portland Cements and Concretes"

CEMENTS: Standard Portland, White Portland, High Early Strength, and Experimental cements—75 in all—covering every possible composition for Portland Cement.

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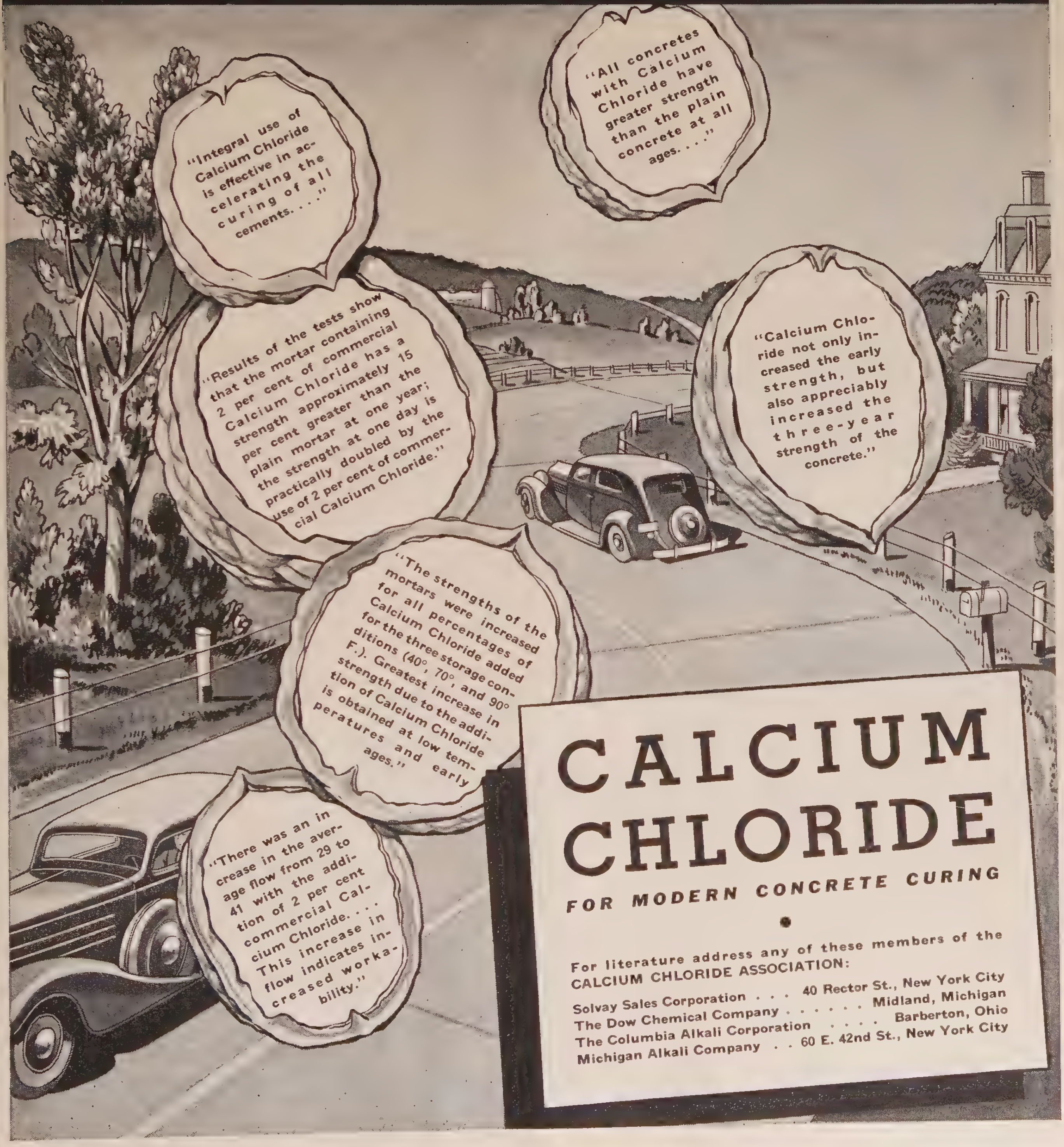
"Integral use of Calcium Chloride is effective in accelerating the curing of all cements. . . ."
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"Results of the tests show that the mortar containing 2 per cent of commercial Calcium Chloride has a strength approximately 15 per cent greater than the plain mortar at one year; the strength at one day is practically doubled by the use of 2 per cent of commercial Calcium Chloride."
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Value of Exterior Waterproofing for Masonry

Long-Time Tests Prove Some Types of Waterproofing Preparations Effective and Durable—Numerous Commercial Products Included in Tests

The waterproofing of masonry surfaces exposed to outside weather conditions is one of the long-standing problems of the construction industry in general, and the concrete construction industry in particular. The magnitude of the problem is well demonstrated by the great number of proprietary materials placed on the market as masonry waterproofers.

In this article—an abstract of a 28-page report by Daniel W. Kessler in the March (1935) Journal of Research of the National Bureau of Standards—the reader will find an important contribution to the subject.—Editor.

A SERIES of tests to determine the effectiveness and durability of waterproofing treatments on limestone and sandstone was started by the National Bureau of Standards in 1921. A report* was published in 1924 giving the results obtained during a two-year exposure period. The study has since been extended to a larger variety of treatments and a more representative range of masonry materials. Since there has been a decided demand for information on the preservative value of masonry treatments, some further experiments were made to determine whether the treatments have merit in protecting masonry from common weathering agencies and from decay due to crystallization of water-soluble salts in the pores.

In addition to twenty-nine proprietary treatments, various non-proprietary treatments and a few purely experimental processes were included in the studies.

Materials and Processes

Samples of the proprietary treatments were supplied by the producers at the Bureau's request. In some cases two or more samples under the same trade name were obtained at different times, which afforded a means of determining variations in composition of the products.

Table 1—Proprietary Preparations
[Classification and Composition]

Designation	Waterproofing ingredients		Volatile thinner, solvent or suspension medium
	Per cent	Nature	
		THINNED FATTY OILS	
1a	18	China wood oil	Mineral spirits.
1b	27	do	Do.
2	10	do	Do.
3	16	Fatty oil	Petroleum distillate.
4	29	Fatty oil and aluminum soap	Coal tar distillate.
5	10	do	Turpentine and petroleum distillate.
		THINNED FATTY OILS AND PARAFFIN	
6a	33	Fatty oil and paraffin (ratio 52:48)	Mineral spirits.
6b	33	China wood oil and paraffin (ratio 43:57)	Petroleum distillate.
7a	38	Fatty oil and paraffin	Do.
7b	26	Fatty oil and paraffin (ratio 83:16)	Do.
8	24	China wood oil and paraffin ratio 64:35)	Mineral spirits.
		THINNED VARNISHES	
9	32	Oils and resins	Mineral spirits.
10	38	do	Do.
11	39	do	Do.
12	38	Coal tar resin	Coal tar naphtha.
		ALUMINUM SOAP SOLUTIONS	
13a	4	Aluminum soap	Mineral spirits.
13b	4	do	Mineral spirits and turpentine.
14	3.4	Aluminum soap and wax (ratio 8:1)	Mineral spirits.
15a	7	Fatty oil, aluminum soap, and resin	Petroleum distillate
15b	12	Heavy mineral oil and aluminum soap	Do.
16	2	Aluminum soap	Do.
17	4.5	do	Petroleum distillate and ethyl acetate.
18	5	do	Coal tar distillate.
19a	4.7	Aluminum soap, fatty oil, and resin	Turpentine and petroleum distillate.
20	?	Aluminum soap and paraffin	Petroleum distillate.
		AQUEOUS EMULSIONS	
21a	5	Casein glue and aluminum soap	Water.
21b	3.2	Glue, aluminum soap, and wax	Do.
22	4	Glue and aluminum soap	Sodium soap solution.
23	12	Linseed oil	Sodium carbonate solution.
24	33	Paraffin	Sodium soap solution.
		WAX SOLUTIONS	
25a	14	Paraffin	Petroleum distillate.
25b	12	Paraffin and other waxy material	Do.
26a	7	Paraffin	Mineral spirits.
26b	15	do	Do.
27	7	Paraffin and other waxy material	Coal tar distillate.
		MISCELLANEOUS	
28a	7.5	Cellulose nitrate	Ethyl acetate and acetone.
28b	10	do	Amyl acetate and fusel oil.
29	8.5	Fatty matter and ammonium soap	Diethylene glocol.
30	—	Fatty oil (about 4%) and a high boiling petroleum distillate	Some lower boiling petroleum distillate.
31	1	Petroleum grease	Petroleum distillate.
32	15	Magensium fluosilicate	Water.

The approximate compositions of these treatments are given in Table 1. Where two samples are designated by the same numeral followed by letters, as 1a and 1b, they are two samples of the same trade designation. In some cases the compositions of two samples of the same trade designation were such as to necessitate their being put under different classifications. Examples of this are as follows: Sample 2 was received under the same trade name as sample 8, sample 11 the same as sample 27, and sample 4 the same as sample 12.

Ten non-proprietary treatments were tried, but several of these did not give sufficient indications of merit in the preliminary trials to warrant further study. These processes are described in Table 2. Process 33 is known as Sylvester's, 34 as Ransome's, and 40 as Caffall's. The others were experimental treatments modeled after those which have been used or suggested as being of possible value.

Table 2—Non-Proprietary Preparations

Designation	Applications	Composition
33	First	2 oz. of alum in 1 gal. of water.
	Second	12 oz. of potassium soap in 1 gal. of water.
34	First	Sodium silicate solution (soda-silica ratio approximately 1:2), density 1.20.
	Second	Calcium chloride solution, density 1.15.
35	Two	Sodium silicate solution (soda-silica ratio approximately 1:2), density 1.20.
36	One	Sodium silicate solution (soda-silica ratio approximately 1:2), density 1.20.
	Followed by several	Limewater.
37	First	10% solution of barium chloride.
	Second	10% solution of aluminum sulphate.
38	One	10% solution of paraffin in gasoline.
39	One	10% solution of beeswax in benzol.
40	One	Paraffin applied with specially designed heating equipment.
41	First	4% solution of ammonium oxalate.
	Second and third	4% solution of calcium chloride.
42	First	10% solution of barium chloride.
	Second and third	10% solution of aluminum sulphate.

Application of Waterproofings

The proprietary treatments were applied to the specimens with a brush in accordance with the directions supplied by the producers. In most cases this consisted of two applications with an interval of at least 24 hours between coats. The specimens were thoroughly dried before being treated and the waterproofings were applied copiously,

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*Kessler, Tech. Pap. BS 18, 1 (1924-1925) T248.

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Compressed Air Operated

For Walls, Columns, Caissons, Etc.

This new Branford vibrator spade operates in a horizontal position—requires no spring for starting and operates at as low a pressure as 20 lbs. to 30 lbs. depending upon the slump.

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Frequency is easily controlled by the valve and ranges from an idling speed of a few hundred strokes per minute up to a maximum frequency of approximately 7500 blows per minute. A flexible connection just above the vibrating unit eliminates shock to the operating handle.

TYPE 1455-B. No. 1 size (shown at left) has a supplementary blade 24" long and 4" wide, corrugated, and is used as an attachment to the standard type 1455-A to produce a smooth, voidless surface, eliminating patching and finishing.

TYPE 1455-A. No. 1 size (shown at right) Blades are 12" long and 4" wide. This spade is especially designed for use between reinforcing and the inside face of the form.

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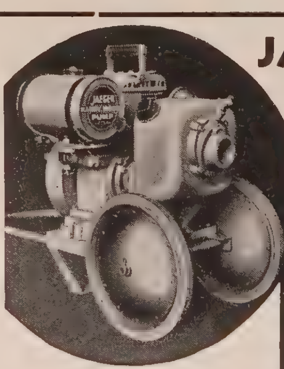

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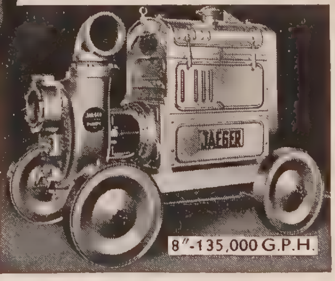

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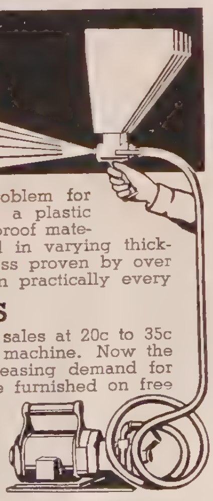

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Ask us about attachment for making the new oscillated waterproof cinder units that is, until absorption appeared to cease. Since the specimens were treated under ideal conditions the results may be assumed to represent the maximum waterproofing values that can be attained with such applications.

The non-proprietary treatments were applied as indicated in Table 2, except the wax solutions, which were applied like the proprietary treatments.

Conclusions

The exterior waterproofings of the composition studied show quite varied effectiveness and durability values. By proper selection of the treatment for any particular masonry it seems possible to obtain good waterproofing results, durability, and some measure of preservative value.

The study has indicated that some compositions may give good waterproofing values when applied to masonry of certain pore structures, but inferior results for other types of pore structure. The problem of adapting the waterproofing to the masonry seems to be one of obtaining adequate penetration. Usually the more viscous solutions, and particularly the emulsions, do not penetrate to a sufficient depth when applied to masonry having small pores. Specific conclusions relating to the merits of the various types are as follows:

1. The thinned fatty-oil type of treatment appears to be fairly satisfactory on materials of medium texture, but not well adapted to the fine-grained or coarse types of masonry. There is probably a slow rate of saponification in contact with calcareous materials. On sandstones of the variety which are satisfactorily waterproofed by this type of treatment, the rate of deterioration is low. Discolorations of an oily appearance are produced by this type.

2. Treatments consisting of fatty oils and paraffin in volatile solvents gave high waterproofing values and satisfactory durability in most of the tests. Those treatments with higher amounts of oil gave less satisfactory waterproofing values on materials of fine pore structure. Discolorations were about the same as for the thinned fatty oils.

3. Thin varnishes did not prove to be very effective and showed a tendency to prevent the escape of absorbed water. The discolorations were more pronounced than for the thinned fatty oils.

4. Aluminum soap solutions usually gave satisfactory initial waterproofing, but showed a high rate of deterioration. The discolorations produced by this type were very slight.

5. Aqueous emulsions of waxes and oils gave unsatisfactory results in most of the tests. There seems to be an unsatisfactory penetration of such treatments when applied to most types of masonry, and the film of wax and oils remaining on the surface not only discolors but collects dirt.

6. Paraffin wax dissolved in volatile solvents proved to be very effective and durable on the materials to which the treatment is adapted. For use on fine-pore structure the effectiveness may be improved by small additions of fatty oil. The melting point of the wax should be sufficiently above summer wall temperatures to prevent the flow of wax out of the masonry. For most localities a melting point of 57 deg. C. (135 deg. F.) is satisfactory. Discolorations of an oily appearance are produced by the treatment.

7. Molten paraffin applied to masonry materials which have been heated somewhat above the melting point of the wax gave very high waterproofing values and had excellent durability. The melting point of the wax should be 57 deg. C. (135 deg. F.) or higher. Usually a film of wax remains on the surface and should be removed to prevent excessive discoloration and accumulation of dirt.

8. Applications consisting of two separate aqueous solutions that react to produce insoluble precipitates in most cases gave poor waterproofing values, and in some cases showed a tendency to cause disintegration.

9. Treatments of the pyroxylin type showed little penetration and the film produced on the surface soon weathered away. This type produces a somewhat glossy and splotchy appearance.

10. The magnesium fluosilicate treatment gave no indications of waterproofing value in any of the tests.

11. Effective waterproofing treatments were of value in increasing the resistance of limestone to frost action, in reducing the destructive effects accompanying efflorescence, and in reducing the solvent action of rain water on calcareous materials.

New Books and Pamphlets

Booklet on Concrete Work

CONCRETE WORK MADE EASY is the title of a 24-page booklet of vest-pocket size, published by the Medusa Portland Cement Co.

In addition to directions for the use of white and colored cements and cement paints, the booklet contains tables giving quantities of materials required for concrete, and for stucco, mortar, floor topping and plaster. Copies of the booklet may be obtained without charge.

Curing of Concrete Slabs

REPORT OF INVESTIGATION ON CURING OF CONCRETE PAVEMENT SLABS has been published by the Highway Research Board, 2101 Constitution Ave., Washington, D. C., as Part II of the *Proceedings* of the thirteenth annual meeting of this organization.

To Get Modernizing Contracts

MODERNIZING MAGIC is the title of a new 16-page, well illustrated publication, 8½ by 11 in. page size, issued by the Portland Cement Association.

This publication was prepared especially as an aid to contractors and products manufacturers in individual or group drives to obtain modernizing contracts. The illustrations are confined mainly to single-family homes and their immediate surroundings.

Single copies may be obtained free from the Portland Cement Association. A larger supply, for use in selling, may be obtained at 3 cents each.

Architectural Concrete Walls

BEAUTY IN WALLS OF ARCHITECTURAL CONCRETE, an elaborately illustrated book of 24 pages, 9 by 12 in. in page size, has been published by the Portland Cement Association, Chicago.

Every architect who contemplates the study of types of architecture to which monolithic concrete is adaptable should have a copy of this publication. From the modernistic treatment of the concrete stadium at Beloit College to the ornamental Gothic details in the tower of Grace Cathedral, in San Francisco, there is an extremely broad range of architectural expression — a range of treatment in which monolithic concrete is proved to be the ideal material. Single copies may be obtained free from the Portland Cement Association.

Solving the Peculiar and Personal Problems of the Industrial Advertiser

NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION, INC.
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TO Advertising Managers, Sales Managers and Executives who sell products to Industrial America:

The 1935 convention of the National Industrial Advertisers Association will bring together in a single three day conference, the answers to many of the problems now confronting the manufacturer covering the advertising, merchandising and sale of industrial products.

The program, carefully planned and balanced by men who have devoted their careers to advertising and sales promotion, is practical, all embracing and highly instructive. It is advanced in the sense of being fully up-to-date but has due regard for established fundamentals.

This program has been created for the executive who is advertising minded and uses advertising as a useful tool, as well as for the specialist who is highly skilled in his profession. Every one who attends this conference conscientiously will carry ideas away which he can profitably employ in his business . . . It is recommended very seriously to all thinking executives.

The conference will be held in Pittsburgh, Pa. September 18th, 19th and 20th at the William Penn Hotel. It is suggested that advance reservations be made through the secretary of the Industrial Advertising Council, P.O. Box 1198, Pittsburgh, Pa., to insure satisfactory accommodations.

Yours sincerely
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General Chairman,
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HOW TO DO IT

Questions and Answers
Consultation and Comment

A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Repairs to Concrete Water Tank

A circular concrete storage tank for water supply, with walls 12 in. thick, built in this town about 12 years ago, has developed leakage at construction joints. Can you suggest a way to stop this leakage permanently?—R. N. H., Texas.

We assume this circular tank has been properly reinforced with steel, and we assume also that the steel passes through the construction joints. It is, therefore, doubly important to stop the leakage through the joints, because if given sufficient time, this water passing through the joints would rust the steel and destroy the tank.

Very likely the most effective way to stop this leakage is to empty the tank, and on the inside face of the wall cut out the joints with cold chisels to a depth of at least 1½ in. The width of the groove that is cut out is not important, except that you must be sure to cut away all concrete that has shown signs of crumbling. In other words, the sides of the groove must be sound concrete. Usually a width of an inch or so is found sufficient.

After a joint has been cut out in this manner, the groove should then be filled by some kind of bituminous material, such as your state highway department uses for filling joints in concrete highways. You should be able to obtain such material through your local building material dealer. The manufacturer of the material will supply instructions covering the method of applying it.

The foregoing method is suggested on the assumption that the tank can be emptied for the length of time necessary to complete the repairs. If, for any reason, you can not make arrangements to have the tank emptied, another method must be followed—one involving the making of repairs from the outside. However, the work can be done most effectively from the inside; and it should be done in this way if it is possible to get along without the supply of water in the tank, while repairs are being made.

Design Tables for Precast Concrete Joists

Have any design tables ever been published that give the load-carrying capacity of precast reinforced concrete joists of various spans?—T. R. W., Michigan.

Such a table was published so recently as July, 1934, in the issue of CONCRETE of that date, on pages 13 and 14. That table shows the required joist spacing, size of steel reinforcement, and slab thickness, for 8-in. precast reinforced concrete joists in the case of an assumed live load of 40 lb. per sq. ft., and for spans up to 18 ft. The live load of 40 lb. per sq. ft. is regarded as more than sufficient for residential buildings such as apartment buildings and single-family homes.

You may be interested also in the fact that an illustrated article in the August (1934) issue of CONCRETE, pages 17 and 18, shows clearly the various steps in the construction of a floor consisting of precast reinforced concrete joists and a cast-in-place concrete slab.

Precast Joist Floor Is Monolithic

Have you ever published any data showing that floor construction consisting of precast concrete joists and a cast-in-place reinforced concrete slab is equivalent to a monolithic reinforced concrete floor?—D. E. R., Pennsylvania.

An article by F. N. Menefee, on pages 5 and 6 of the March (1934) issue of CONCRETE, describes tests which show conclusively that the type of concrete floor construction consisting of precast reinforced concrete joists and cast-in-place concrete slabs produces, in fact, a monolithic concrete floor of the T-beam type. In no case where these beams were tested to the breaking point did the failure occur at the joint between the precast joist and the slab. This last-named fact establishes the monolithic character of the construction, because it shows that the bond between the joist and the slab is just as effective as if both the joist and the slab were cast in place at the same time.

High-Grade Finish for Concrete Floors

What is the best method of finishing concrete floors in a way so as to obtain an attractive appearance—as, for instance, in a living room or dining room floor?—W. B., Illinois.

An ideal method—one that has produced excellent results—is described and illustrated on page 11 of the December (1932) issue of CONCRETE. For the benefit of new readers, who may not have that issue of the magazine at hand, the method of procedure will be given here.

A cement-and-sand mortar topping, of 1:2 proportions, was placed over the structural concrete slab to a thickness of ⅝ in. Mineral colors had been added to the cement, to give the mortar the desired color effect. After the topping was placed, it was screeded off and finished to simulate the somewhat irregular appearance of floor tile.

When the mortar topping had stiffened enough to support knee boards, joints 1 in. wide were cut along a straight-edge by means of a simple tool made of ordinary table-knife blades bolted on each side of a 1-in. piece of wood. As the joints were cut, the loose strip of mortar was removed with a knife blade.

After the slab had cured for 12 hours, the open joints were filled with a 1:2 mortar of white portland cement and sand. Then, when both the mortar topping and the joint mortar had hardened, a natural colored floor wax was applied in two separate coats to the joints, while a mixture of equal parts of red and brown wax, also in two coats, was applied to the squares, or "tiles." This produced a color variation similar to the red tiles on the stair treads.

In so far as the contractor was able to segregate the cost of this floor finish from the rest of the contract, the estimated cost was about 30 cents per sq. ft.

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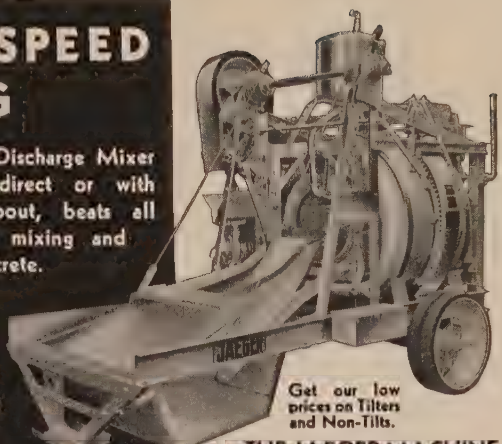

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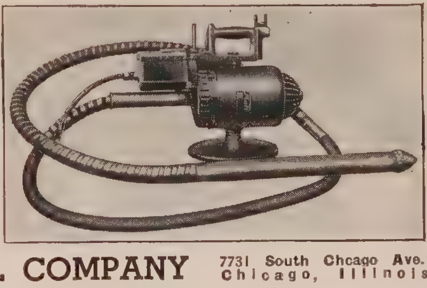

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CONCRETE SPECIALTIES—
How to Make and Sell Them

A 64-page booklet, entitled "How to Make and Sell Concrete Specialties," was published by the Concrete Publishing Company in 1928, and was distributed quite extensively throughout the concrete products industry.

Individual chapters cover the following subjects: (1) Analyzing the market for concrete specialties; (2) concrete burial vaults; (3) concrete septic tanks; (4) concrete fence posts; (5) concrete sills and lintels; (6) concrete silo staves; (7) concrete roofing tile; and (8) concrete floor tile.

A limited number of copies of the booklet, just made available, can again be offered to readers of "Concrete" while the supply lasts, at the reduced price of 50 cents a copy, which is half the publisher's price of $1.00.

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EQUIPMENT AND MATERIALS

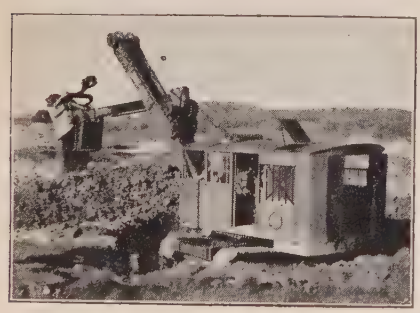
POZZOLITH for More Permanent Concrete is the title of a new booklet being distributed by The Master Builders Co., Cleveland, Ohio. Pozzolith, they say, is a gelatinous colloid with high pozzolanic properties which makes possible a decrease in the water-cement ratio while at the same time maintaining plasticity.

It produces its unique effect, they say, by an action on the cement paste portion of the mix which increases both mobility and cohesiveness without materially disturbing the size relations and is, therefore, effective without respect to the design of the mix. The value of a pozzolanic material is that, by combination with free lime from the cement, it reduces the solubility of the concrete. Practically, this action enhances resistance to freezing and thawing and to corrosive attack. Evidence of this protection is found in the results of tests with Pozzolith, they say.

Pozzolith, a synthetic pozzolana, is a new development.

◆

LINK-BELT Company, Chicago, announces the perfection of two new models of crawler-mounted shovels, cranes, draglines to be known as models K-40 and K-45. It is stated that the new machines embody features which assure their attaining the maximum in ease of operation and maintenance, in performance and in service life.

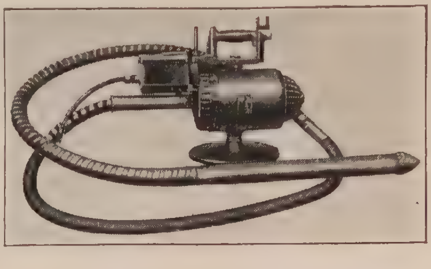


New Model Link-Belt crawler shovel

The Link-Belt line of crawler shovels, cranes, draglines now comprises six models ranging from ¾ to 3-cu. yd. capacity. All are built for heavy-duty service and arranged for gasoline engine, Diesel engine, or electric motor drive.

◆

A CONCRETE vibrator unit with either a 2¾-in. or 3¼-in. diameter vibrator powered with a new type 3-hp. 3-phase, totally enclosed, dust and vapor proof motor has been recently introduced by the Mall Tool Company, Chicago. The machine, they say, can be used under the most adverse conditions. Switch and motor are fully protected against burnouts. The machine is light weight and easily portable. Can be furnished with 14, 21, or 28 ft. of flexible shafting, depending upon the depth of the forms; also attachments for concrete rubbing, grinding, drilling, and sawing.



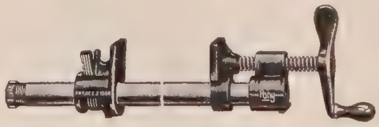
Mall vibrator with new type motor

High speed gas engine power units are also available.

◆

PONY steel bar clamps, made by the Adjustable Clamp Co., 429 No. Ashland Avenue, Chicago, are designed to make ¾-in. steel pipe—either standard or extra heavy, with American or British pipe threads—serve as a bar.

These clamps may be had complete, or the fixtures only for use with pipe on hand.



The Pony clamp

Adjustment is secured by multiple disc clutch which grips the bar automatically at any point and permits fitting the clamp to the work, the screw being required only to apply pressure. The foot is never loose on the bar. but is easily released by finger grips.

The Adjustable Clamp Co. makes a complete line of clamps, described in Catalog No. 10.

Industrial Literature

"HOW to Handle It" is a new catalog, which shows in picture form the various types of material handling equipment manufactured by Chain Belt Company, Milwaukee, Wis.

◆

AERIAL Wire Rope Tramways for freight transportation is the subject of a 108-page book just issued by American Steel & Wire Company, with sales offices in 28 principal cities.

Aerial tramways are adaptable to many and varied conditions to be met in the transportation of commodities, from a stem of bananas to a four ton load of rock. The book is thoroughly illustrated with photographs of some of the applications of the company's aerial tramways handling bulk materials, packages or manufactured articles.

Tramways are classified as continuous bi-cable, double or single reversible, monocable, monorail, or special equipment.

No one system of aerial tramways is adapted to meet the variety of demands. The company claims that the wide experience of their engineers and the facilities at their command enable them to design a type of aerial transportation well fitted to individual needs.

There is an interesting history of wire rope and early installations of aerial transportation systems with a discussion of the cost of operation.

The power unit may be either electric motor, gasoline or diesel engine.

Manufacturers' News

FOUR Fruehauf semi-trailers form a connecting supply link between the railroad terminal and the dam site by hauling 65-barrel loads of bulk cement day and night over a 4½-mile construction road with 8 per cent upgrade at Norris Dam, being constructed by the Tennessee Valley Authority.

Fruehauf trailers in service at Norris Dam

Vol. XLIII
No. 7

Cement Mill Section of
Concrete

July
1935

Regional Cement Marketing Companies?

Appalachian Coals Organization May Be Solution to Puzzle Created by Supreme Court—Cement Industry May Continue Work Started Under NRA Code

SPOKESMEN for many industries have, during the past month, urged the maintenance of wage rates and hours of work in their respective groups, to cover the interval between the Supreme Court decision invalidating NRA codes and the time when industries can put into effect some form of voluntary agreement.

Many Industries Taking Action

The iron and steel industry, for illustration, announced on June 6 that more than 200 members, representing 91 per cent of ingot capacity and 90 per cent of finishing capacity, had decided to continue the practices under which that industry operated under the NRA code. This is to include maintenance of rates of pay, maximum hours of labor, and standards of fair competition.

On the same day the board of directors of Automotive Parts and Equipment Manufacturers, Inc., passed a resolution urging the automobile industry to maintain fair standards of wages, hours, and working conditions, and through voluntary methods to eliminate unfair methods of competition.

The shoe industry, early in June, at its annual convention in Chicago, took aggressive steps toward the establishment of its own code of fair competition. Even the coat and suit manufacturing industry announced on June 6 that it had gone through the formalities of dissolving its NRA code authority and immediately reorganizing it as a voluntary body.

To Hold Their Gains

Later in the month the National Sand and Gravel Association announced that a meeting of its board had been called for July 10 and 11, to consider proposals for carrying on under some voluntary agreement. The lumber industry, likewise, is working on a plan whereby the advantages of the NRA code may be maintained under the control of the industry itself.

In the various branches of the concrete construction industry, the opinion of the leaders favors some form of action that will maintain the progress made under the NRA codes. In the construction section of this issue of CONCRETE, for example, letters from spokesmen for the concrete products industry and the ready-mixed concrete industry show clearly that the leaders of these groups are eager to hold the gains made during the past two years.

And finally, on June 11, the board of trustees of the Cement Institute announced a unanimous vote in favor of retaining the wage and hour provisions which had prevailed under the NRA code, and members of the industry were urged to comply with the board's recommendations.

Chiselers Also Active

But in contrast with the scores of announcements of the intention to comply with code provisions on a voluntary basis, numerous individual industrial establishments have reduced wages and lengthened hours of work. One industrial plant even notified its employees that a wage increase ordered by the NRA, and in effect for several months prior to the Supreme Court decision, would be deducted from the pay envelopes.

No one, of course, is so artless as to believe that mere resolutions by boards and recommendations by leaders will serve the purpose very long. Announcements of the kind published by the press throughout the month of June undoubtedly had a good psychological effect. But without something more substantial, in the nature of agreements and contracts, the 5 or 10 per cent of troublemakers by which almost every industry is cursed will not be long in starting their demoralizing tactics.

Appalachian Coals May Be the Answer

What, then, can the cement manufacturing industry do about it?

It is the belief of many that this question can be answered by three words — *Appalachian Coals, Incorporated!*

The words *Appalachian Coals* have been on the tongues of many during the month of June. Convention speakers have referred to this unique sales organization—unique for this country—and groups of individuals, discussing "the way out," have considered it.

The unique position of *Appalachian Coals*—and the point of greatest interest to the cement manufacturing industry—is due to the fact that it actually possesses the benediction of the United States Supreme Court. Following a series of court fights which had dragged along for three years, and in the course of which the coal industry had lost in the lower courts, the Supreme Court, in an 8-to-1 decision, handed down on March 13, 1933, reversed the lower courts and gave its approval to this type of sales organization.

In consequence, the cement manufacturing industry, no less than other industries, can,—if it will—work out a marketing organization having a legal structure similar to that of *Appalachian Coals*, and thereby have the assurance that it may proceed without being subjected to endless court attacks.

Operation of Appalachian Coals

What, then, is the form of the sales and promotional organization known as *Appalachian Coals, Incorporated*—the organization that sells the output of 147 coal mining companies that operate 269 mines in four states.

Following the decision of the Supreme Court, the organization was reconstructed in conformity with that decision, and on April 17, 1933, it began to function as *Appalachian Coals, Incorporated.*

To begin with, this organization operates on the basis of specific contracts whereby *Appalachian Coals, Incorporated* acts as sales agent for the 147 independent coal mining companies. Then, in turn, *Appalachian Coals, Incorporated* has appointed 115 sub-agents, consisting mainly of the sales subsidiaries of the coal companies themselves. But the manner in which *Appalachian Coals* operates is best told in extracts from a paper presented by C. B. Huntress, president of the organization, before the annual meeting of the National Coal Association on October 26, 1934.

"In review of the manner in which a coal sales agency works," says Mr. Huntress, "let us turn back to late March, 1933, when prices resembled a crazy quilt. Before April 17, 1933, when *Appalachian Coals, Incorporated* was started, but after it became apparent that such an agency was about to function, the market stiffened, buyers became apprehensive of their ability to beat down prices to any level, sellers gained stamina, prices went up; and there was a further rise when the first A.C.I. price list was published. This strengthened the prices on all coal produced in the A.C.I. area, and later had its effect in other fields. At the same time the utmost moderation was applied to domestic prices. Immediately—that is, back in April, 1933—six months before code operation, such trade practices as prepayment of freight, special terms to retailers, consigned coal, were kicked out of the window and, thanks to the A.C.I. contract, they have remained out of the window, in fact as well as in name.

"The agency (*Appalachian Coals, Incorporated*) has contracts with 147 coal mining companies, operating 269 mines, with a potential capacity of 85 million tons annually."

Companies Subscribe to Stock

After telling about the contracts with the 147 coal mining companies and the appointment of 115 sales organizations as sub-agents, Mr. Huntress explained how the company affiliation is represented by subscriptions to common and preferred stock.

"The subscription," he said, "was based on one share of common stock for each 100,000 tons, or major fraction thereof, of 1931 production. There are 5,753 shares, $100 par value, of 7 per cent cumulative preferred stock on which one call of 25 per cent has been made and paid, amounting to $143,825, and on which one dividend has been paid. The preferred stock was subscribed to on the following basis: Where a producer appointed a sub-agent the stock was calculated at 15 cents on a ton for one-twelfth of the 1931 tonnage of that producer; where a sub-agent was not appointed the basis of subscription was fixed at $1.50 per ton for one-twelfth of the 1931 production.

"In all cases sub-agents have been named, due to the realization that in the beginning, at least, the sale of such a large tonnage could be handled only through the established sales organizations. It might here be added that there is a substantial amount of coal sold by the sub-agents through wholesalers on specified terms. Sub-agents, if they do not sell through a wholesaler, receive 8 per cent of the mine price; otherwise, 5 per cent, the wholesaler receiving a certain number of cents, depending on the grade, and, respecting domestic coal, depending on the territory. In 1933 *Appalachian Coals* received a commission of 2 per cent of the mine price of the coal; but in 1934, by action of the board of directors, is receiving one per cent on all sales."

In another paper, read before the annual meeting of the American Institute of Mining and Metallurgical Engineers on February 18, 1935, Mr. Huntress again presented detailed information as to the inner workings of *Appalachian Coals*. These details need not be given here, though it should be stated that in addition to the marketing division, there are departments covering coal inspection, market research, traffic, fuel engineering, and publicity.

Not All Producers Are Members

Not all mines in the four states comprising area covered by *Appalachian Coals* are affiliated with the organization. As previously stated, A.C.I. has contracts with 147 independent companies operating 269 mines. These produced 43 million tons in 1934, amounting to 74 per cent of the total commercial production in that area. Outside the *Appalachian* group are 293 mines—but these produced only the remaining 26 per cent of the total. A majority of these "go along" with the *Appalachian* group in the matter of prices; but it is inevitable that a minority of "non-conformists" are causing some trouble. Their combined annual production, however, is very small.

How Cement Marketing Company Operates

It will now be in order to discuss briefly the methods of operation of the Cement Marketing Company of India, Ltd., described in an article by Walter Buchler on pages 90 and 91 of the February (1931) issue of the *Cement Mill Edition* of CONCRETE.

The Cement Marketing Company of India is built on the pattern of similar marketing organizations in England. While it is true that the laws under which it operates differ from our laws, the actual operation of the organization, as here described, has nothing to do with the laws under which the sales organization was created.

Production Is Regulated

The marketing company regulates the output for each company, and it effects great economies in distribution by supplying the various markets from the nearest plants. It sells all the cement produced by its member companies. The cement is sold on the basis of brands. It is sold f.o.b. cars. Each cement manufacturing plant pays the salary of a railway booking clerk, who is attached to the plant personnel. He checks the contents of all freight cars carrying cement, and seals the cars.

All orders for cement are handled through the cement marketing company, which allocates them to the nearest plant, except for the adjustment that may be necessary to give each plant its full quota for the year.

Selling Agencies

The system of marketing—as with *Appalachian Coals*—involves the ap-

(*Continued on page 41*)

Clay-Gypsum Cement—Composition and Manufacture

Get Much Higher Strength in Early Hardening Period Where Dead-Burned Gypsum Replaces Part of Slaked Lime

By DR. PETER P. BUDNIKOFF
Professor, Laboratory of Silicate Technology, Institute of Chemical Technology, Charkoff, U.S.S.R.

CEMENT from a mixture of clay with lime (so-called "glinite-cement") is usually obtained by burning clay at 700 to 900 deg. C. and subsequently grinding it with 25 to 35 per cent of slaked lime, $Ca(OH)_2$. The quantity of $Ca(OH)_2$ that is added depends for the most part upon the physical and chemical properties of the burned clay, and upon its chemical composition.

Glinite cement does not possess a high compressive strength, especially during the early hardening period, which apparently can be explained as due to the forming of a hydrosilicate gel and a calcium hydro-aluminate and its subsequent densification and crystallization.

An addition of 2 to 3 per cent of gypsum, when grinding glinite cement, in many cases increases somewhat the compressive strength of the cement.

Greater Strength with Dead-Burned Gypsum

For the purpose of raising its compressive strength, especially at the early hardening stages, investigations covering the replacement of $Ca(OH)_2$ by a mixture of dead-burned gypsum with $Ca(OH)_2$ have been undertaken. The gypsum was burned at 600 to 700 deg. C.

Table 1 shows the chemical analyses of the materials used in the investigation. Table 2 shows the physical analysis of the clays used. These raw materials were burned in oil-burning muffle kilns during a period of two hours, at the following temperatures:

(1) Gypsum, from Artemowsk—
  (a) At 700 deg. C.
(2) Kaolin, from Ukrainia—
  (a) At 700 deg. C.
  (b) At 800 deg. C.
  (c) At 900 deg. C.
(3) Clay "RW," from Tshasow-Yar—
  (a) At 700 deg. C.
  (b) At 800 deg. C.
  (c) At 900 deg. C.
(4) Local clay, from Charkow—
  (a) At 700 deg. C.
  (b) At 800 deg. C.
  (c) At 900 deg. C.
(5) Chalk, from Belgorod—
  (a) At 1,150 deg. C.

The burned materials were ground with a laboratory ball mill to the fineness shown in Table 3.

Slaked lime (the slaking was completed in 3 days) was screened with the aid of a sieve having 64 meshes per sq. cm. (20 meshes per lin. in.).

TABLE 1—CHEMICAL ANALYSES OF MATERIALS USED IN THE INVESTIGATION

Material	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	SO_3	Alkalies	Loss on Ignition
1. Gypsum	1.62	0.26	0.10	——	32.01	0.52	46.05	——	20.61
2. Kaolin from Ukrainia	47.13	37.48	0.72	0.27	1.01	0.11	——	——	13.32
3. Tshasow-Yar clay "RW" from Ukrainia	51.81	31.35	0.93	1.09	1.15	0.31	——	2.48	9.55
4. Local clay from Charkow	73.52	8.57	5.43	——	3.28	0.43	——	——	5.92
5. Chalk from Belgorod (near Charkow)	0.54	(0.54)*		——	53.58	0.41	——	——	43.73

*Combined Al_2O_3 and Fe_2O_3.

TABLE 2—PHYSICAL ANALYSES OF CLAYS, IN PERCENTAGE OF TOTAL

Material	Residue on sieve of 900 meshes per sq. cm.*	Fine sand	Sand dust	Silt	Clay matter, particles less than 0.01 mm.
Kaolin from Ukrainia	None	2.50	2.00	6.25	89.25
Tshasow-Yar clay "RW," from Ukrainia	None	3.00	1.00	5.50	90.50
Local clay from Charkow	1.92	41.32		30.22	25.92

*Equivalent to 76 meshes per lin. in.

TABLE 3—FINENESS OF GRIND

Material	Burning temperature, in deg. C.	Residue on Sieve, per cent of total: 900 meshes* per sq. cm.	Residue on Sieve, per cent of total: 4,900 meshes* per sq. cm.
1. Gypsum from Artemowsk	700	1.3	12.5
2. Kaolin from Ukrainia	700	1.1	10.5
3. Kaolin from Ukrainia	800	1.0	9.4
4. Kaolin from Ukrainia	900	1.1	10.8
5. Clay "RW," from Tshasow-Yar	700	1.2	12.5
6. Clay "RW," from Tshasow-Yar	800	1.2	11.0
7. Clay "RW," from Tshasow-Yar	900	1.3	12.3
8. Local clay, from Charkow	700	1.4	12.8
9. Local clay, from Charkow	800	1.0	10.0
10. Local clay, from Charkow	900	1.2	12.2

*900 and 4,900 meshes per sq. cm. are equivalent, respectively, to 76 and 178 meshes per lin. in.

Preparation of Samples

On the basis of preliminary investigations a number of mixtures were prepared. The composition, fineness of grind, the amount of water added, and the time of setting, of every mixture, are shown in Table 4. The results of compressive tests are given in Tables 5(A), 5(B), 5(C) and 6.

From the cements produced (See Table 4), standard sample briquets and cubes were prepared, and were subjected to tests after storage in air, in water, and in combined air-and-water storage. For the air storage the samples were placed into a moist-air chamber. For water storage and for combined storage, the samples were placed in water 24 hours after being made. Zinc-plated iron containers, filled with water, were used for this purpose. After 7 days, the samples intended for combined storage were removed from the water and placed into moist-air chambers—the same as the samples stored in air.

With the view of obtaining more data on physical strength, the briquets broken in tension were subjected to the compression test (See Table 6). The halves were placed over each other in such a way that the broken edges were turned in opposite directions.

THEORETICAL CONSIDERATIONS

Action of Clay When Heated

In 1887 Le Chatelier[1] established that all clays, when heated, decompose

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[1] Le Chatelier, Bull. Soc. Franc. de min. 1887.

Table 4—Composition, Fineness of Grind, Amount of Added Water, Time of Set

	Burning temperature of clay, deg. C.	Clay used	Clay	Composition of cement, in percentage Anhydrite, $CaSO_4$	Slaked lime $Ca(OH)_2$	Fineness of grind, residue on sieve 900 mesh/cm²	4,900 mesh/cm²	Mixing water, per cent 1:0	1:3	Time of setting Beginning, hr. and min.	End, hr. and min.
1.	900	Kaolin	70	20	10	1.1	12.0	—	13.7	—	—
2.	900	Kaolin	30	60	10	1.2	12.5	46.0	11.2	2-25	6-15
3.	800	Kaolin	70	20	10	1.0	12.1	56.5	13.75	2-50	4-50
4.	700	Kaolin	70	20	10	1.2	12.5	—	12.5	—	—
5.	700	Kaolin	30	60	10	1.2	12.5	44.3	10.6	3-35	9-45
6.	900	Clay "RW"	70	20	10	1.3	12.4	55.0	13.5	3-10	5-20
7.	900	Clay "RW"	30	60	10	1.3	12.4	46.8	11.5	4-50	8-45
8.	800	Clay "RW"	70	20	10	1.2	11.5	54.2	13.25	8-45	4-20
9.	800	Clay "RW"	30	60	10	1.2	12.0	46.5	11.5	7-10	9-00
10.	700	Clay "RW"	70	20	10	1.2	12.5	56.5	13.7	3-25	6-20
11.	700	Clay "RW"	30	60	10	1.3	12.5	48.0	11.5	4-35	8-20
12.	900	Local clay	70	20	10	1.40	12.6	37.5	8.8	4-00	5-45
13.	900	Local clay	30	60	10	1.3	12.5	38.2	9.0	1-30	3-20
14.	800	Local clay	70	20	10	1.10	11.2	37.5	8.8	5-10	6-55
15.	700	Local clay	70	20	10	1.2	12.4	37.5	8.8	4-50	6-05
16.	700	Local clay	30	60	10	1.3	12.7	38.2	9.0	2-20	5-15

Table 5A—Tensile and Compressive Strength of Specimens Stored in Water

Number	Tensile strength of briquets, in lb. per sq. in.			Compressive strength of cubes, in lb. per sq. in.		
of Test	7 days	28 days	3 months	7 days	28 days	3 months
1	173	200	192	1,290	1,340	1,690
2	—	—	—	—	—	—
3	—	208	183	—	1,080	1,335
4	—	—	—	—	—	—
5	—	—	—	—	—	—
6	124	132	140	945	1,135	975
7	—	—	—	370	550	655
8	122	168	171	1,205	1,160	1,555
9	—	117	—	—	825	—
10	—	—	—	495	610	580
11	—	—	—	—	—	—
12	—	189	236	695	1,205	2,060
13	—	188	233	—	1,620	2,045
14	—	—	—	590	680	720
15	—	—	—	885	955	1,065
16	164	130	132	—	1,620	1,690

Table 5B—Tensile and Compressive Strength of Specimens Stored in Air

Number	Tensile strength of briquets, in lb. per sq. in.			Compressive strength of cubes, in lb. per sq. in.		
of Test	7 days	28 days	3 months	7 days	28 days	3 months
1	212	172	158	1,145	1,710	1,620
2	125	122	121	1,150	1,230	1,160
3	232	244	230	1,435	1,540	1,220
4	182	182	158	990	1,230	1,140
5	121	178	228	1,120	1,640	1,635
6	182	171	140	1,285	1,490	1,360
7	142	158	134	735	1,140	1,065
8	185	205	249	1,480	1,710	1,480
9	117	125	114	—	915	1,470
10	130	171	145	920	980	840
11	—	—	—	525	515	540
12	108	200	285	605	1,580	2,100
13	180	330	405	1,730	2,085	2,210
14	145	200	188	1,230	1,690	1,840
15	164	183	171	1,360	1,630	2,025
16	208	297	318	1,675	2,440	2,575

Table 5C—Tensile and Compressed Strength of Specimens in Combined Water and Air Storage

Number	Tensile strength of briquets, in lb. per sq. in.		Compressive strength of cubes, in lb. per sq. in.	
of Test	28 days	3 months	7 days	3 months
1	188	142	1,230	1,230
2	—	—	—	—
3	255	245	1,210	1,420
4	—	—	—	—
5	—	—	—	—
6	166	140	1,340	1,375
7	—	—	445	665
8	200	213	1,440	1,280
9	144	91	1,315	1,470
10	—	—	685	645
11	—	—	—	
12	250	293	1,620	2.170
13	309	394	1,590	2,760
14	—	—	770	1.105
15	162	140	1.715	1.710
16	272	287	2,035	2.540

Table 6—Compressive Strength of Briquets of 1:3 Mortar, in Lb. Per Sq. In.

Number	Water storage			Air storage			Combined storage	
of test	7 da.	28 da.	3 mos.	7 da.	28 da.	3 mos.	28 da.	3 mos.
1	1,705	1,760	1,470	1,710	1,655	1,480	1,620	1,310
2	—	—	—	1,375	1,200	1,155	—	—
3	—	1,710	1,485	1,645	1,965	1,540	1,830	1,825
4	—	—	—	1,350	1,510	1,190	—	—
5	—	—	—	1,345	1,470	1,350	—	—
6	1,215	1,485	1,220	1,595	1,710	1,310	1,590	1,255
7	—	—	—	1,620	1,690	1,150	—	—
8	1,440	1,370	1,400	1,765	1,430	1,835	1,640	1,550
9	—	1,265	—	1,570	1,470	1,285	1,450	1,235
10	—	800	840	1,260	1,370	1,290	1,140	1,145
11	—	—	—	—	755	945	—	—
12	660	1,570	1,810	1,305	1,890	2,240	2,110	2,215
13	—	1,890	1,890	1,665	2,295	2,915	2,360	2,105
14	875	945	945	1,440	1,620	1,515	810	1,295
15	855	945	1,080	1,395	1,655	1,405	1,730	1,510
16	1,620	1,940	1,570	2,180	2,225	2,265	2,615	2,325

into free oxides and acquire hydraulic properties. In contact with lime they form the compound $CaO.SiO_2.2.5H_2O$.

W. Wernadsky[2] gives the following process in the transformation of clay matter under the influence of heat:

(1) *Kaolin* ($Al_2O_3.2SiO_2.2H_2O$) heated up to 400 to 500 deg. C. becomes *leverrierite* ($Al_2Si_2O_7+2H_2O$).

(2) When heated up to 1,000 to 1,200 deg. C., kaolin becomes *sillimanite* ($Al_2O_3.SiO_2+SiO_2$).

(3) When heated above 1,200 deg. C., kaolin becomes *mullite* ($3Al_2O_3.2SiO_2$).

T. W. Mellor and H. D. Holdcroft[3] ascribe the exothermic effect near 1,000 deg. C. to complete decomposition of meta-kaolinite to Al_2O_3 and SiO_2.

T. F. Hyslop[4] gives the following transformations of kaolinite:

(1) $4(Al_2O_3.2SiO_2.2H_2O)$ when heated to 550 deg. C. becomes $4Al_2O_3.3SiO_2+5SiO_2+8H_2O$.

(2) $4Al_2O_3.3SiO_2$ when heated to 850

(*Continued on page 42*)

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[2] W. I. Wernadsky, *Clay Anhydrides* (leverrierite group). Papers of the Acad. of Science, 1923, pp. 27-29.

[3] T. W. Mellor and H. D. Holdcroft, Trans. English Ceramic Soc., 10, 1911.

[4] T. F. Hvslop, Trans. of the Ceramic Soc., 24, 1924-1925.

Tests of Pozzolanic Activity

Where Vicat and Rivot Tests Are Not Applicable —Definition of Pozzolanic Activity

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Summary. Statement of the problem—The present lack of a series of tests for pozzolanic activity—The dual meaning of the word *pozzolana*—The two possible types of tests that can be devised—The uselessness of the first type and the value of the second—When can it be assumed that a material possesses pozzolanic properties?—The four fundamental properties to be tested—The need for discarding old type tests such as the Rivot method for the determination of soluble silica—The Vicat test and the principle upon which it is based—The need for revising this principle if the Vicat test is to be applied to all types of materials—The inherent limitation of the Vicat test.

THE successful solution of the problem of determining whether or not a certain material evinces pozzolanic activity hinges upon the successful solution of another problem—that of elaborating a series of tests capable of giving, in a reasonable length of time, a reliable measure of such pozzolanic activity.

It is now almost a hundred years since the French engineer, L. J. Vicat, proposed what can be considered as the first, chronologically, of this type of tests; yet very little progress has been made to date, toward the elaboration of a thoroughly satisfactory way of detecting the pozzolanic nature of a certain material.

The failure seems at first hard to explain, in view of the widespread interest in pozzolanic materials aroused by Vicat, continued unabated during these intervening hundred years, and culminated, finally, in recent times, with the manufacture of blended cements and pozzolanic cements.

Meaning of Word Pozzolana

It is only when we probe into the ambiguous meaning of the simple word *pozzolanic* that we begin to realize that there may be an explanation for that failure in the very difficulties which beset the way of detecting the existence of pozzolanic materials.

The word pozzolanic has in fact a double meaning. It designates, on the one hand, the complex of physico-chemical properties which characterizes a peculiar type of natural materials found in limited quantities and in restricted areas. It stands, on the other hand, for the complex of physico-chemical properties which characterizes the resulting product of the intimate mixing of lime and pozzolana in the presence of water.

Looking at things from a superficial point of view, it would seem at first that the search for, and the testing of, pozzolanic materials should end with a search for, and the testing of, materials evincing the characteristic properties of pozzolanic materials.

What these properties are was briefly summarized in the article "What Is Pozzolana?" published in the May (1935) issue of the *Cement Mill Edition* of CONCRETE.

Obviously, then, the tests devised, once they had disclosed the presence or the absence of such properties, would naturally furnish the desired solution.

But, apart from the fact that some of those properties are too elusive to be detected by simple tests, it still remains true that we are, in our present state of knowledge, not altogether certain whether the secondary characteristics of pozzolanic materials—namely, the production of hydraulic cementitious compounds through reaction with lime—which always accompanies the primary ones constituted by their physico-chemical properties, is always depending upon or deriving from them.

In other words, materials may be found in their natural state, or even artificially produced, evincing pozzolanic activity without necessarily possessing the physical structure and the chemical composition of natural pozzolanas. That is, of course, a pure hypothesis, but a hypothesis somewhat justified by the evidence of variable degrees of pozzolanic activity shown by materials which differ quite radically from natural pozzolanas, both in their physical structure and their chemical composition.

It may be, in fact, extremely difficult to find materials which would give rise, in the presence of an excess of lime water, to the same swelling evinced by true pozzolanas. And yet, there are many materials, which, without evincing such a property, can nevertheless be classified as pozzolanic.

Lime-Pozzolana Reaction

We are brought, therefore, to the point of devising means by which it is possible to test the characteristics of the product of the lime-pozzolana reaction, rather than those of the pozzolanic material itself. The question hinges thus upon the clear recognition of the secondary characteristic of pozzolanic materials—that is, upon the clear recognition of the function fulfilled by a material when it can be assumed to have a pozzolanic nature. It may be here stated that a material evinces pozzolanic nature "*when it reacts chemically with lime, the product of the reaction being a hydraulic cementitious substance characterized by a high chemical resistance at all ages and a physical resistance increasing with the passing of time.*" This definition, rendered thus independent of requirements of morphological structure, physical characteristics, chemical composition, etc., of the basic material itself, implies a search for, and the testing of, properties such as:

(a) Chemical reactivity of the material for lime.

(b) Hydraulic cementitious value of the product of the lime-pozzolana reaction.

(c) Resistance of the same product to the action of chemically aggressive agents.

(d) Physical strength of the same product expressed as a function of the time element.

These four properties are not only all equally valuable, but they must also be all equally present in the product of the lime-pozzolanic materials reaction if a division of these materials into the two broad classifications of true pozzolanic and of non-pozzolanic, or inert, can be satisfactorily achieved. It appears that one is thus amply justified in restricting the word *pozzolanic* to those materials which, besides showing a chemical affinity for lime, satisfy also the additional requirements of production—through reaction with lime—of a hydraulic cementitious material of high chemical and physical resistance.

The Rivot and Vicat Tests

Assuming, then, that this way of interpreting the whole issue of adequate tests for pozzolanic activity is the correct one, it appears at once evident that one of the most widely-known types of tests used at present to detect such activity—the Rivot method—with its subsequent modifications[1] for the analysis of the total quantity of acid-soluble and alkali-soluble silica contained in a pozzolanic material, loses all its importance and remains simply an indication of a certain property of materials evincing pozzolanic activity. This property has, in fact, a very indefinite connection with such activity, and perhaps very little bearing on the ultimate behavior of the resulting cementitious mass when subjected to the action of physical and chemical agents.

The same thing, in a modified way, applies to the Vicat test.

The principles upon which this test is based is, as stated by Vicat: *"The energy of a pozzolana is directly proportional to the quantity of lime which it is capable of fixing during a determinate length of time."*

Where the Assumption Holds

The correctness of this principle depends on the correctness of the assumption which underlies it—that is, on the assumption that the lime fixed by the material when immersed in a lime solution, is chemically combined within the individual particles rather than mechanically held at their surface. Or, in other words, that the lowering of the lime concentration of the solution is the result of true chemical reactions, rather than an effect of surface adsorption.

In the case of natural pozzolanas the assumption holds perfectly true, for we do know that in their case the lime becomes fixed as a result of a chemical reaction deriving from a base exchange between the alkalies of the alkaline silico-aluminates forming the matrix of pozzolanas and the lime itself—reaction which gives birth to a calcium silicate of alumina of high hydraulic cementitious value.

Not True in All Cases

But in the case of other materials this assumption does not necessarily hold true. Placing, in fact, pure silica sand ground exceedingly fine (so as to leave no residue on the 325-mesh sieve) into a lime solution, there is noticed a progressive lowering of the concentration of the solution—lowering which indicates a fixing of the lime by the silica sand. But whether this effect is the result of chemical causes, rather than mechanical ones, remains very difficult to establish. And even admitting that there is present a true chemical reaction, it still remains to be proved that the product of the lime-silica reaction taking place under ordinary conditions of temperature and pressure is a calcium silicate of the cementitious type, and not simply a calcium silicate low in lime, perfectly inert as to hydraulic cementitious effect.

To extend, therefore, the test of Vicat indiscriminately, from true pozzolanas to all types of materials, and draw from the results of the test the same conclusions in all cases, appears entirely unwarranted, if not completely erroneous. All that can be said, then, is that this test can be applied to all those materials for which the basic principle underlying it holds true, when this principle is modified along the following lines: *"The energy of a pozzolanic material is directly proportional to the quantity of lime which, during a determinate length of time, the material is capable of fixing in stable chemical combinations evincing hydraulic cementitious value."*

Modifying the Vicat Test

Thus modified, the principle would hold true in all cases, and the test can be applied to all types of materials, *provided that it can be supplemented by complementary ones capable of detecting the type of the lime combination formed, and its hydraulic cementitious value.*

In the practice of the test great attention must be paid to the presence of a phenomenon, which, left undetected, might vitiate, and possibly falsify, all results.

This phenomenon, not noticed by Vicat for a reason which shall be presently given, consists of a discrepancy between the values of lime and alkalinity concentration of the solution in which the mortar of lime-pozzolanic material has remained immersed for a certain length of time.

This warning of the presence of such a discrepancy can not be too strongly emphasized on account of the general habit of measuring only the alkalinity concentration of the solution and assuming it to be equivalent to the lime concentration of same. Now, while in the case of natural pozzolanas this assumption is quite correct, in the case of other materials it does not necessarily hold true; and, as a matter of fact, it is almost always faulty.

Vicat Tested Only Natural Pozzolanas

Vicat, of course, who was experimenting with natural pozzolanas and determining their behavior, could have no inkling of the phenomenon in question; but the fact remains that there are materials, advertised nowadays as pozzolanic, which, when placed in solutions of lime water and tested for lime *actually* liberated or fixed, furnish results totally at variance with the results obtained by determining the increase or decrease of alkalinity of the solution. Furthermore, while the practice of the Vicat test, as evolved during these last hundred years, has emphasized the use of sugared lime rather than the use of plain lime solutions, for true natural pozzolanas, the emphasis must be reversed again whenever the attempt is made to apply the Vicat test to materials other than true natural pozzolanas.

The reason for this reversal of practice lies in the possibility of the attack of the calcium aluminates present in the pozzolanic materials by the sugared lime solution, which, breaking up that type of compounds, brings about a fictitious increase of alkalinity concentration.

Finally, the Vicat test is a very slow one in all cases. All devices evolved to make of it an accelerated test which would give within a reasonable length of time—say a few days, for instance—an indication of pozzolanic activity, have so far miserably failed. At the same time the assumption that the law governing the behavior of a pozzolanic material immersed in a lime solution during a long period of time can be deduced from the law governing the behavior of this material during its first few days of immersion, is an entirely arbitrary and unwarranted assumption. It happens, in fact, that while for true natural pozzolanas the curve representing the law of pozzolanic activity as a function of the time element in terms of lime concentration can be represented by a straight line, the curve representing the law of pozzolanic activity of some of the materials advertised today as "pozzolanic" is often of the type of a curve such that its first derivative offers no safe indication of constancy of future trend.

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[1] Florentin, Baire, Malquori, etc.

Conclusions

All these facts point to the conclusion that to extend the Vicat test from natural pozzolanas to other materials without being first aware of the discrepancies which are bound to be encountered, may lead to entirely erroneous results.

It may also be well to point out that even in its application to natural pozzolanas the Vicat test presents some very undesirable factors worthy of being mentioned, as, for instance—

(a) The small amount of lime fixed—an amount which, even in the case of the best natural pozzolanas, is almost always smaller than 0.05 gram of CaO fixed per gram of pozzolana after 28 days of treatment.

(b) The fact that the test is devoid of all value if it is not run as a comparative one in which the basis of comparison is a natural pozzolana of known pozzolanic activity.

(c) The need of carrying out the test in an atmosphere free of carbon dioxide, to eliminate all possibility of alteration of the results. These results, in fact, being very small numerically, would be adversely affected by the presence of the film of calcium carbonate which would eventually form at the surface of a solution left in contact with air.

The final conclusion that appears justified from the above discussion is that the Vicat test can not offer a very effective contribution to the problem of determining accurately in a reasonable length of time the pozzolanic nature of certain material, and that, following the way of the Rivot test, it may be completely discarded in the very near future.

The question that arises then is: What type of test can take its place?

The discussion of this question will form the subject of the next article.

Cement Marketing

(*Continued from page* 36)

pointment of "agents," who, for the most part, are large firms of dealers. These large dealers, located in the various large population centers, sell at prices fixed by the Cement Marketing Company, and they are allowed a commission of 5 per cent. Cutting of commissions is discouraged, and "agents" who indulge in this practice are warned if found out. Agents buy in carload lots, receiving 40 to 60 days credit; and, in turn, the agents sell to "stockists." Every town in India has a "stockist" of cement; and he, in turn, sells to small dealers, small contractors, and so on. Large contractors usually buy direct from the large dealer "agent," thereby saving from 4 to 10 per cent in the price.

Traveling Sales Supervisors

The Cement Marketing Company, on its part, has sales supervisors traveling around the country all the time, keeping in touch with the agents, and through them with any important construction work planned or in progress. Generally, the agent accompanies the sales supervisor, who interviews contractors, engineers and architects, to ascertain what construction projects may be in the offing, and gives advice where needed. The agent keeps the sales supervisor in his area continually informed of developments and sales, and the latter makes reports to the head office at regular intervals.

Concerning the Supreme Court decision of March 13, 1933, upholding *Appalachian Coals, Incorporated*, this was discussed in a brief manner in an editorial on page 31 of the April (1933) issue of the *Cement Mill Edition* of CONCRETE.

Adapted to Cement Industry

In conclusion, it seems evident that because of the many similarities in the production and distribution of cement and that of coal, cement marketing companies can be operated in a manner analogous to the operation of *Appalachian Coals*. Unlike India, no one marketing company would be permitted to handle all cement produced in the United States. That would be regarded as a "monopoly." But one all-inclusive marketing company is not necessary. Seven or eight groups, each covering certain geographical areas, would doubtless do their work more effectively than one group, even if the latter were permitted to exist.

No difficulty should be involved in adjusting the legal structure of *Appalachian Coals, Incorporated* to meet the requirements of a cement marketing group. For this purpose a 38-page book, entitled *Appalachian Coals, Incorporated*, would be indispensable.

Acknowledgment: Much of the information contained in this article has been made available through the courtesy of C. B. Huntress, President, Appalachian Coals, Inc., Transportation Building, Cincinnati, Ohio.

Setting and Hardening of Portland Cement

An article by K. Koyanagi, in *Zement*, page 705, 1934, on the setting and hardening of portland cement, is discussed in the May (1935) issue of *Cement and Cement Manufacture*. The author points out that the disadvantages of microscopical methods in the investigation of the setting and hardening of cement are that the material can not be examined at early dates.

A method has been developed by which the fraction from a cement smaller than 10 microns in diameter is separated by sedimentation in absolute alcohol and mixed with 40 per cent of water. The mixture is placed on a microscope slide and a cover glass pressed on. Sections can be obtained 10 microns and less in thickness, and can be protected from atmospheric action. The behavior of various cements and the effect of various additions have been examined. The sections are examined between crossed nicols. After the specimen has been prepared, the crystals of cement gradually disappear and the field becomes dark; after five to six hours a few points of light are observed which in about twelve hours may be recognized as crystals; later they grow bigger to form hexagonal plates and prisms. After about three days the field of view is filled with crystals.

A similar effect is seen on the addition of calcium chloride to ordinary cement. When a minute amount of sugar is added it stops the formation of crystals until fourteen days have passed, and even at this period they are very small and poorly developed. It was found that during the setting of cement there was practically no crystal formation. Crystal formation occurs during the hardening period, and the crystals consist of calcium hydroxide. From this it is seen that the hardening of cement is due to the crystallization of calcium hydroxide.

Clay-Gypsum Cement

(*Continued from page 38*)

deg. C. becomes *sillimanite*, $3(Al_2O_3.SiO_2)+Al_2O_3$.

(3) $Al_2O_3.SiO_2+Al_2O_3$ when heated to 1,060 deg. C. becomes *mullite* $(3Al_2O_3.SiO_2)$.

In the process just shown the products of decomposition of *kaolinite* are the compounds $4Al_2O_3.3SiO_2$, and (at the higher temperatures) *sillimanite* and *mullite*.

In another series of investigations it was established that kaolin burned at any temperature can not be looked upon as a simple mixture. Those tests disclosed that the immersion of dehydrated kaolin into bromoform ($CHBr_3$) did not lead to a separation of Al_2O_3 and SiO_2, and treatment with a 5 per cent soda solution did not lead to a solution of SiO_2, such as would have occurred if the dehydration product had been a mixture of the above-named oxides.[5] The latter fact provides evidence of a bond existing between Al_2O_3 and SiO_2.

N. K. Antonewitsh,[6] investigating the hydraulic properties of feebly burned clays, also came to the conclusion that the dehydration of kaolin is followed by the formation of the compound $Al_2O_3.2SiO_2$, in which Al_2O_3 and SiO_2 are completely bound, but which possesses a great chemical activity that develops hydraulic properties which mixed with lime paste. An X-ray investigation of kaolinite dehyrated at 700 deg. C. disclosed the presence of only feeble traces of a crystalline structure—very indistinct lines of kaolinite.[7] Thus it can be concluded that the product obtained by the dehydration of kaolin at about 750 deg. C., known as meta-kaolinite or kaolinite anhydrite, contains Al_2O_3 and SiO_2 in a distinct relation, though the Al_2O_3 possesses a considerable mobility inside the silica skeleton. This can explain the absence of clearly expressed properties of a crystalline structure.

The influence of the burning temperature of kaolin on the activity of this material, and the processes taking place during the setting of clay-gypsum cement, will be the subject of the second (and final) installment of this article.—Editor.

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[5] P. A. Zamiatshenski, "The Question of Changes in Kaolinite at High Temperatures." Trans. Inst. of Phys. Chem. Analysis, Proceedings of Meetings, 1924, II, 499-500.

[6] N. K. Antonewitsh, "Hydraulic Properties of Kaolinite Clays." Proc. Ceramic Inst., Leningrad, Vol. 32, 1931.

[7] O. Krause, Ber. d. Deutsches Keram. Gesellschaft, Bd. 8, Heft 2, 1927, p. 114.

Specifications for Pozzolanic and Slag Cements

Russian Standard Requirements Similar to German Specifications

THE Russian standard specifications for cement cover portland cement, pozzolana-portland, slag-portland, and Roman cement, and standard sand. The following condensed requirements for the three special cements named, taken from the May (1935) issue of *Cement and Cement Manufacture,* will be of interest to the American cement industry.

Pozzolana-Portland Cement

Pozzolana-portland cement is obtained by grinding portland cement clinker with more than 10 per cent of hydraulic materials such as pozzolana, trass, diatomaceous earth, etc. The amount of portland cement in the product may vary between wide limits. No chemical analysis is required.

Setting Time.—Initial set must not be less than 20 minutes, and the final set not longer than 12 hours.

Soundness. — The cement must be sound after hot and cold water tests.

Fineness.—Residue on the 900-mesh* sieve must not be greater than 2 per cent, nor that on the 4,900-mesh* sieve greater than 20 per cent.

Tensile Strength.—1:3 mortar made with standard sand must have a strength of at least 12 kg. per sq. cm. after 7 days and 16 kg. after 28 days.

Compressive Strength. — 1:3 mortar made with standard sand must have a compressive strength not less than 80 kg. per sq. cm. after 7 days and 160 kg. per sq. cm. after 28 days.

General Instructions.—Testing must be carried out in the same way as for portland cement.

Slag-Portland Cement

Slag portland cement is obtained by grinding portland cement clinker with granulated basic blast-furnace slag of suitable composition. The amount of slag must not exceed 85 per cent. Gypsum may be added in amounts up to 3 per cent, by weight, of the mixture. Neither the SO_3 nor the MgO content may be greater than 5 per cent. The MnO content in the finished product must not exceed $x = 5 \cdot \frac{a}{100}$ where a = per cent slag in the cement. In other respects the cement must conform to the specification for pozzolana portland.

Roman Cement

Roman cement is made by grinding together unsintered burnt natural or magnesia marl, artificial magnesia limestone mixtures, or dolomite with clay material. After burning, this product must not fall to a powder when mixed with water. The SO_3 content must not be greater than 3 per cent.

Setting Time.—Initial set must not be less than 15 minutes, and final set not longer than 24 hours.

Soundness.—The cement must be sound to the cold water test after 4 days in air.

Fineness.—The residue on the 900-mesh sieve must not be greater than 15 per cent.

Tensile Strength.—1:5 mortar made with standard sand must have a tensile strength not less than 5 kg. per sq. cm. after 28 days in air saturated with water vapor, and 3 kg. per sq. cm. after 28 days in water.

Compressive Strength.—1:5 mortar made with standard sand must have a compressive strength of not less than 15 kg. per sq. cm. after curing in moist air for 28 days, and not less than 10 kg. per sq. cm. after 28 days in water.

Sampling.—An average sample must be taken for every 1,000 barrels. In other respects the instructions for portland cement must be followed.

Testing.—The methods of testing are the same as for portland cement, except for the following alterations: 300 g. of Roman cement are to be used for the cement paste. Mortar of normal consistency is made with 1 part cement to 5 parts standard sand; the amounts used are to be 130 g. cement and 650 g. sand.

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*The 900-mesh and 4,900-mesh sieves here mentioned are equivalent, respectively, to 76 and 178 meshes per lin. in.

◆ EDITORIAL ◆

Appalachian Coals May Show the Way

The cement manufacturing industry was one of the first of the nation-wide groups to see the advantages of a code of fair competition possessed of "teeth," and this industry was one of the first to start action toward the preparation of a code under the NRA.

It may be said, also, that the cement manufacturing industry was *not* one of those that assumed an attitude of resentment and opposition toward Washington—on the contrary, this industry co-operated with the government in every way. While the code was not precisely what everyone wanted, and while various interests from outside the industry were the cause of considerable difficulty, the members of the cement industry had ample reason to know that the NRA code created conditions that were infinitely more desirable than the unbridled competition which preceded the code period.

Few cement manufacturers have any desire to return to that unbridled and destructive competition, now that the Supreme Court has invalidated the code.

What, then, is to be done about it? The leaders of the industry have lost little time in taking up this important problem. The board of trustees of the Cement Institute held a series of sessions in Chicago on June 10 and 11, in the course of which a statement was issued to the industry, urging all cement manufacturers to maintain code wages and hours, regardless of the Supreme Court decision.

That statement is in line with numerous similar statements issued by the spokesmen of industries, and doubtless such statements have a good psychological effect. Everyone knows, however, that psychological effect soon wears off. No industry can co-operate indefinitely on a purely voluntary basis, for sooner or later the selfishness and stupidity of a few are certain to upset everything.

Doubtless, also, the leaders of the cement industry know that practically all industry is now "on the spot." Under the ten months' extension of a modified NRA, the various industries have the opportunity to prove that they can operate on some co-operative contract basis, or else they must confess their inability to do so.

In this respect the cement industry—with many others—is fortunate in having before it a living example of industrial co-operation in the form of Appalachian Coals, Incorporated, the operation of which is described in the leading article in this issue.

There are parallels between the coal mining industry and the cement manufacturing industry. Both are producers of basic products. In both cases the ultimate market, or a considerable part of it, is reached through independent retail dealers. Both industries are greatly over-developed as regards producing capacity. In the Appalachian Coals group there are 147 companies operating 269 mines in four states. In the cement industry of the entire nation there are some 89 companies operating 180 manufacturing plants. In any given geographical area the number is, of course, much smaller, and the problem is simplified accordingly.

Above all things, the Appalachian Coals group has already received the sanction of the United States Supreme Court. In consequence, any group of cement manufacturers—as, for instance, those located in any given geographical area—has presented to it the opportunity to build up a central marketing organization by following the legal framework of Appalachian Coals. Regarding the actual operating details, much may be learned from the cement marketing companies of England and India, described in our issues of February, 1931, and October, 1932.

One hears much, in these days, of Appalachian Coals. The leaders of the cement industry will do well to make a careful study of that organization, with the view of adapting its principles to the marketing of cement as well as to the control of fair trade practices.

Kill the $1,400 Limit

It is of the utmost importance to the cement manufacturing industry that the notorious "$1,400 limit" promulgated by the Works Progress Administration be removed or substantially modified.

This wholly impractical ruling, established by men who know little or nothing about construction, will—if it is allowed to remain—prevent the undertaking of permanent and useful public works projects such as paved highways and grade-elimination structures. Yet these were two of the types of work specifically mentioned by the President in his message recommending the huge work-relief appropriation.

Cement manufacturers can not afford to allow this ruling to upset the entire purpose behind the Work-Relief Act. Regardless of what action the organizations representing the cement manufacturing and highway construction industries may be taking, every individual cement manufacturer should contact the members of Congress of his state, and try in this way to turn the spot-light on this ruling while Congress is in session.

Resistance of Cements in Corrosive Solutions

Test Specimens Only Partly Immersed—Results of German Investigation

INVESTIGATIONS on the corrosion of cements have usually been carried out on totally immersed specimens, but in a recent number of *Zement* Professor O. Graf states that this method gives misleading results, since concretes which are unattacked when tested by total immersion fail in practice when the structure is only partly immersed. Professor Graf describes a series of tests carried out as closely as possible in accordance with practical conditions. Twelve cements were tested, comprising four ordinary portland cements (*B*, *T*, *L*, *S*), one high-strength portland cement (*D*), three blast-furnace cements (*A*, *V*, *J*), two aluminous cements (*W*, *N*), and two mixed cements (*P*, *Tr*), respectively, portland-jurament and trass cement. The aggregate was Rhine quartz sand of sizes 0.2/1 mm., 1/3 mm., 3/7 mm., 7/15 mm., and 15/30 mm. Two sizes of specimens were used—10 by 10 by 10 cm., and 56 by 10 by 10 cm.

The specimens were placed in the various liquids after 14 days' curing. The prisms were immersed to a depth of 18 cm. and the cubes totally immersed. To observe the effect of agitation of the solution, the solution was stirred by compressed air for one hour morning and evening in some of the tests. Specimens were also cured in solutions in hermetically-sealed containers. The immersion waters used were Stuttgart tap water with 0.9 per cent Na_2SO_4, 2.1 per cent Na_2SO_4, 2.4 per cent $MgSO_4$, and 5 per cent NaCl; artificial sea water; Stuttgart mineral water; distilled water; and ordinary Stuttgart tap water. The solutions in the containers for the specimens were renewed after 1, 2, 3, 4, 6, 9, 12, 15, 18, and 21 months. The specimens were tested for appearance of surface, alteration in weight, and bending and compressive strengths. The results obtained are as follow:

Portland Cement

SPECIMENS STORED IN 0.9 AND 2.1 PER CENT Na_2SO_4.—Corrosion first appeared in the immersed portion as fine cracks at corners and edges, and these grew larger and opened with time. There were also blistering and scaling. Later considerable corrosion occurred at the liquid-air surface, particularly on the tamping face. The corrosion was generally stratified, and was greatest on the outside. Above the surface the salt crystallized out in masses like hoar frost or down.

SPECIMENS STORED IN $MgSO_4$, 2.4 PER CENT SOLUTION.—The corrosion was largely due to scaling in the portion under the solution. The salt separated out mainly as thick crusts above the liquid level.

SEA WATER.—Fine cracks appeared on the edges, and the separation of salts was less than in the foregoing tests.

5 PER CENT NaCl.—Only a small amount of salts separated out on the portion in air. No cracks or scaling were observed.

STUTTGART MINERAL WATER.—(CaO, 0.091 per cent. MgO, 0.0071 per cent. SO_3, 0.0927 per cent. Cl, 0.1123 per cent. Na_2O, 0.1048 per cent. CO_2 combined, 0.0454 per cent; free, 0.0126 per cent; active, 0.0096 per cent).—No changes were observed except for a very small separation of salts on the portion in air.

DISTILLED WATER.—No changes.

Blast-Furnace Cement

2.1 PER CENT Na_2SO_4 AND 2.4 PER CENT $MgSO_4$.—The corrosion was in general the same as for ordinary portland cement.

SEA WATER.—Cracks formed chiefly at the liquid surface near the edges and only in one of the two cements tested.

5 PER CENT NaCl.—Only crumbling on the surfaces in air was observed.

STUTTGART MINERAL WATER, DISTILLED WATER, AND STUTTGART TAP WATER.—No changes, except for a slight separation of salts, were noticed.

Aluminous Cement

2.1 PER CENT Na_2SO_4.—At first a considerable separation of salts occurred. Near the liquid-air line small white and yellow grains formed near which the concrete flaked. Later, large cracks appeared chiefly at the liquid-air level and the concrete broke up by scaling. Most of the corrosion occurred in the portion in air.

2.4 PER CENT $MgSO_4$.—Cracks formed without much weakening of the concrete. If there was corrosion it occurred within a short period of time, hence there is a danger that specimens which show no corrosion at two years may later fail very rapidly.

SEA WATER.—The behavior was similar to Na_2SO_4.

5 PER CENT NaCl.—Considerable amounts of white and yellow particles formed on the immersed portions. Apart from a little scaling this portion showed no corrosion. The portion in air, however, fell to pieces.

Mixed Cement

In Na_2SO_4 and $MgSO_4$ solutions, the corrosion and separation of salts was in general the same as for portland cement. In mineral water there were no marked changes.

In the case of specimens immersed in Na_2SO_4 solution it was found that by far the greatest concentration of salts occurred at about 1 cm. under the surface of the specimens. Very little salt was found in the center of the test pieces. For those immersed in $MgSO_4$ solution the largest amount of salt occurred in the immersed portion of the specimen, but none was found in the center portion. In the case of sea water and 5 per cent NaCl the salt was uniformly distributed through a horizontal section and more salt was found in the portion in air.

Effect of 0.9 and 2.1 Per Cent Na_2SO_4 on Strength

PORTLAND CEMENT.—In general, the strength of the portion in the solution was greater than that in air. After two years there was little difference in the bending and compressive strengths of cement *B* specimens cured in these solutions and those in ordinary water. The other cements were more or less seriously affected. Concrete with cement *B* took up the least amount of liquid of the four cements. No simple relation could be obtained between the constitution of the cement and resistance to corrosion.

BLAST-FURNACE CEMENT.—The behavior was similar to that of portland cement. Cement *A* was nearly as good as *B*. The CaO content of *A* was much lower than that of the other two (*V* and *J*).

Aluminous Cement.—The corrosion was greatest in the upper portion of the prisms. No strength figures were obtained at two years, as the specimens fell to pieces completely.

Mixed Cements.—Trass cement behaves better than portlandjurament, but was not better than portland cement *B*. The strength varied from 0.85 to 1.16 times that of specimens cured in water.

Effect of 2.4 Per Cent $MgSO_4$ on Strength

Portland Cement.—Cement *B* stood up well; the others were poor.

Blast-Furnace Cement.—Cements *A* and *V* were satisfactory. Cement *J* had a lower compressive strength.

Aluminous Cement.—The strength of cement *W* was very low in parts, while *N* was satisfactory.

Mixed Cements.—After two years a reduction in strength was clearly noticeable.

Effect of Sea Water on Strength

Portland Cement and Blast-Furnace Cement.—The strengths were satisfactory.

Aluminous Cement.—The strengths of the middle and upper portions were very low or nil.

Effect of 5 Per Cent NaCl on Strength

Portland Cement and Blast-Furnace Cement.—No noticeable reduction in strength was observed.

Aluminous Cement.—In the middle and upper portions the strength was practically nil.

Effect of Stuttgart Mineral Water on Strength

All except the mixed cements were satisfactory. The mixed cements had a much lower bending strength, but the compressive strength was not affected.

Effect of Distilled Water and Stuttgart Tap Water on Strength

Portland and blast-furnace cements stood up well. There was a reduction in strength of the two-year specimens of aluminous cement *W*.

In general, there was little difference between specimens stored in still and agitated solutions.

The tests show that aluminous cement is not so good as portland and blast-furnace cements when immersed in Na_2SO_4 solution, $MgSO_4$ solution, sea water, NaCl solution, or mineral water. Aluminous cement specimens stored in closed containers where no evaporation could take place were affected much less than when there was access to the atmosphere.—From *Cement and Cement Manufacture* (London), February, 1935.

Safety Competition Winners

Announcement of the winners of the National Safety Competition of 1934, in which recognition was given to outstanding safety records attained during the calendar year 1934 by numerous mines and quarries, was made on June 4 by John W. Finch, director, United States Bureau of Mines, Department of the Interior, which sponsored the contest. Three hundred and thirty-four mines and quarries in 38 states participated in the competition and notable accomplishments were achieved in their operation without accidents or with quite low accident rates. The competing companies were divided into five classes: Anthracite mining companies, bituminous-coal mining companies, metal mining companies, operators of nonmetallic mineral mines other than coal mines, and quarries or open-cut mines. A replica of the bronze trophy, "Sentinels of Safety," donated by the magazine, Explosives Engineer, was awarded to the winning company in each group.

In the nonmetallic mineral group, first place was given to the LaSalle mine of the Marquette Cement Manufacturing Co., Oglesby, Ill., which was operated through 105,376 man-hours without a lost-time accident.

Honorable mention was given to the following named mines in the nonmetallic group:

Wampum mine, Wampum, Pa., of the Crescent Portland Cement Co.

Independence mine, Independence, Mo., of the Missouri Portland Cement Co.

In the group comprised of quarries and open-cut mines, the following-named operations were given honorable mention. All of these mines or quarries operated without a lost-time accident in 1934.

LaSalle quarry, Oglesby, Ill., of the Marquette Cement Mfg. Co.

Cape Girardeau No. 2 quarry, Cape Girardeau, Mo., of the Marquette Cement Mfg. Co.

Ruegg quarry, Ruegg, Mo., of the Missouri Portland Cement Co.

Ormrod quarry, Ormrod, Pa., of the Lehigh Portland Cement Co.

Cowell quarry, Cowell, Calif., of the Cowell Portland Cement Co.

Fordwick quarry, Fordwick, Va., of the Lehigh Portland Cement Co.

Berkeley Nos. 5 and 6 quarry, Martinsburg, W. Va., of the North American Cement Corp.

Union Bridge quarry, Union Bridge, Md., of the Lehigh Portland Cement Co.

Fogelsville quarry, Fogelsville, Pa., of the Lehigh Portland Cement Co.

Glens Falls quarry, Glens Falls, N. Y., of the Glens Falls Portland Cement Co.

Brooksville quarry, Brooksville, Fla., of the Florida Portland Cement Co.

Martins Creek No. 4 quarry, Martins Creek, Pa., of the Alpha Portland Cement Co.

Mitchell quarry (Lehigh Lime Co.), Indianapolis, Ind., of the Lehigh Portland Cement Co.

Nazareth quarry, Nazareth, Pa., of the Lone Star Cement Co.

Birmingham quarry, Birmingham, Ala., of the Lehigh Portland Cement Co.

Lone Star quarry, Greenport, N. Y., of the Lone Star Cement Co. of N. Y., Inc.

Petoskey quarry, Petoskey, Mich., of the Petoskey Portland Cement Co.

New Castle quarry, New Castle, Pa., of the Lehigh Portland Cement Co.

Catskill quarry, Catskill, N. Y., of the North American Cement Corp.

Clinchfield limestone quarry, Clinchfield, Ga., of the Pennsylvania-Dixie Cement Corp.

Thomaston limestone quarry, Thomaston, Me., of the Lawrence Portland Cement Co.

El Paso quarry, El Paso, Texas, of the Southwestern Portland Cement Co.

Dallas quarry, Dallas, Texas, of the Lone Star Portland Cement Co., Texas.

West Conshohocken quarry, West Conshohocken, Pa., of the Valley Forge Cement Co.

Dewey quarry, Dewey, Okla., of the Dewey Portland Cement Co.

Catskill quarry, Catskill, N. Y., of the Alpha Portland Cement Co.

Stockertown quarry, Stockertown, Pa., of the Hercules Cement Corp.

New Book on Crushers

Crushers for Stone and Ore—Their Development, Characteristics, and Capabilities. By William T. W. Miller. Published by Mining Publications, Ltd., 724 Salisbury House, London, E. C. 2, England. Cloth binding, 234 pages, 6 by 9 in., extensively illustrated. Price 15 s.

This book will prove itself extremely helpful to cement plant operating officials, because of the detailed manner in which the author has described the many varieties of crushing machinery in service today. These included the jaw crusher, the gyratory crusher, single-roll crushers, disc crushers, swing-hammer crushers, and so on, with their many variations.

Men and Mills

News of and for Cement Mill Men

A clearing-house page for all kinds of news about cement men and cement mills. ℂ Readers in all mills, even though not regular contributors, are invited to send in news notes about personal and plant activities that may be of interest or value to the men in other mills.

Paul F. Keatinge of the *Universal Atlas Cement Company* was elected president of the Producers' Council Club of Chicago at its annual meeting at the Lake Shore Athletic Club on May 24.

●

The Marquette Cement Manufacturing Company, Chicago, with a plant at Cape Girardeau, Missouri, has been awarded a contract for 100,000 barrels of cement f. o. b. government barges at Cape Girardeau, at $210,000, by the United States War Department.

●

The Fredonia (Kansas) employees of the *Consolidated Cement Corporation* were given a banquet on June 5, in appreciation of a remarkable safety record. On June 1 the employees had worked a total of eight hundred and eighty-one days without a lost time accident.

●

Employees of the *Lone Star* cement plant at Dallas, Texas, participated in a nation-wide "June no-accident campaign" sponsored by the Portland Cement Association of Chicago. Announcement of plans for this concentrated safety drive was made by *William Moeller*, superintendent of the local plant.

●

Pacific Portland Cement Company, San Francisco, submitted the low bid for supplying 565,000 barrels of cement for Bonneville dam to the United States army engineers, on a proposal of $916,522. The Santa Cruz Portland Cement Company bid $1,018,500 and the Beaver Portland Cement Company, $1,030,300.

●

Felix Guenther, Jr., has been appointed chief engineer of *Pennsylvania-Dixie Cement Corporation* with headquarters at Nazareth, Pa., and *Norman V. Geyer* has been appointed superintendent of Plant Number 1 at Kingsport, Tenn. *W. H. Klein*, general operating manager of the corporation, made the announcement.

●

D. B. Coleman, safety engineer of the *Missouri Portland Cement Company*, recently inaugurated a "Safety Essay" contest, along the lines of the one conducted a short time ago by the *Southwestern Portland Cement Company*. The contest was conducted as a portion of the preliminary activities preceding the "June-No-Accident" campaign, and it was announced by the company that the winners would be presented with prizes at the June 1st flag-raising. The contest was open to employees, their wives and children and prizes awarded ranged from $2.50 to $10.00. Subjects on which essays were to be written were:

The Value of Plant Inspection in Eliminating Accidents.
The Value of Safe Tools and Equipment in Eliminating Accidents
The Value of Good Housekeeping in Eliminating Accidents
The Value of Personal Safety in Eliminating Accidents
The Value of Safety Rules in Eliminating Accidents
The Value of First Aid in Eliminating Accidents
The Value of Safety Equipment in Eliminating Accidents
The Value of Highway and Home Safety in Eliminating Accidents

Contestants could choose their own subject from the above list and essays were limited to three hundred words.

Another activity of the Missouri company which deserves special mention is the publication of their employees' newspaper. The *Red Ring Record*, of which *Miss Ziers* was the editor, and sponsored by the Kansas City mill, has now been merged with the *Mill and Quarry News*, sponsored by the St. Louis mill, and the joint publication is known now as the *Red Ring Record*.

●

Great Lakes Portland Cement Corporation, of which *Adam L. Beck* is president, has begun activities in preparation for the special June Safety campaign among its workers.

The corporation has been awarded the 1934 Portland Cement Association trophy for completing a calendar year without a single disabling accident to employees. This is the second consecutive year the Buffalo plant has won the trophy.

●

Officials of the *Manitowoc Portland Cement Company*, Manitowoc, Wisconsin, opposed a proposed survey of the feasibility of a state-owned cement plant recently at an assembly labor committee hearing, claiming the inquiry would uncover its business secrets to competitors.

H. Vanderwerp, vice president of the only cement mill in the state, said the committee would be empowered by the bill to "subpoena all the experience of years of the Manitowoc company" and would be "taking property without due process of law."

Employees of the *Kosmos Portland Cement Company* and the *Louisville Cement Company* were awarded national recognition for a perfect safety record during last year's operations by industrial leaders meeting in New York. These plants at Kosmosdale, Ky., and Speed, Ind., carried out safety campaigns under the direction of *A. C. Brown*, plant manager, and *F. H. Compton*, superintendent, respectively.—Louisville, Ky., *Times*.

●

The Pacific Portland Cement Co. has closed negotiations for taking over the distribution in seven Western states of Milcor metal lath and other building products of the Milcor Steel Corp. of Milwaukee.

●

The *Buffington* plant of the *Universal Atlas Cement Company* has been awarded the trophy for a perfect safety record during 1934. The award was made formally on June 27.

National, regional and local leaders in industry, business and government, attended the presentation ceremonies.

The plant was open for inspection. The management made particular effort to entertain employees' families at the celebration, including an inspection trip where wives and children observed plant conditions under which the men work.

The Carl D. Bradley, large self-unloading boat of the Bradley Transportation Company, was in the harbor for demonstration.

The trophy was presented by Edward Mehren, president of the *Portland Cement Association*. The trophy, designed by the Chicago Art Institute, weighs four tons. It is an eight-foot concrete slab, two ft. thick and five ft. wide. The award was made in recognition of the Buffington plant's achievement in going through an entire calendar year without a single lost-time accident. In 1933, a sprained ankle suffered in a fall by an employee marred an otherwise perfect record. Since that mishap in February, 1933, 842 days have passed without a serious accident and all employees are co-operating to extend the record to at least 1,000 days to win further recognition.

The safety committee of the plant responsible for the perfect record and celebration plans included *Mr. Kempster*, *J. B. Lewis*, assistant general superintendent; *A. E. Freudenreich*, *William Hennebohle*, *E. O. Elliott*, *T. Russell, Jr.*, *E. Christiansen*, *G. E. Stromquist* and the safety inspector, *F. Sass*. All are department heads.

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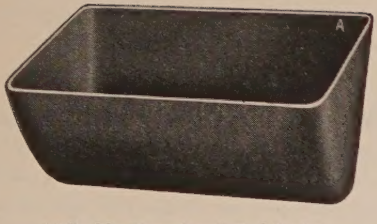
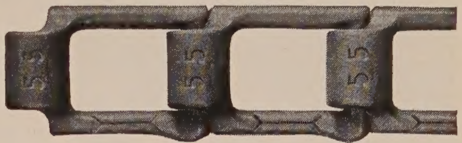
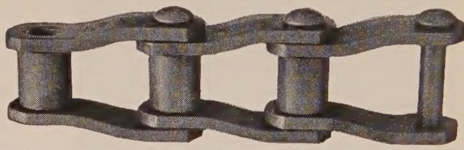


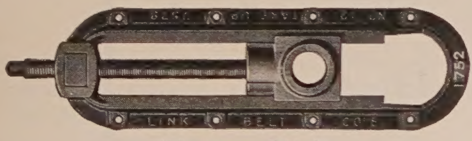
Malleable, Promal and steel buckets of all types.



Promal and Malleable Iron Chains of all types

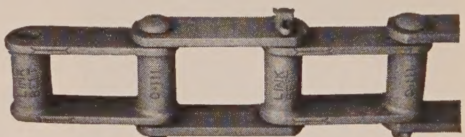


Steel chains for every conveying and power transmission service.



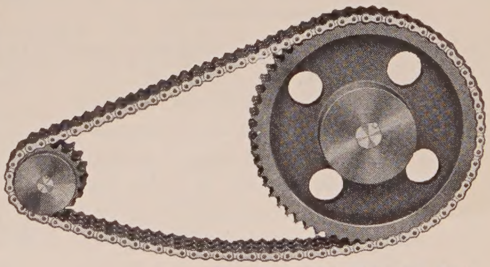
Take-ups — all kinds.

Pulleys of all types for power transmission and conveying.

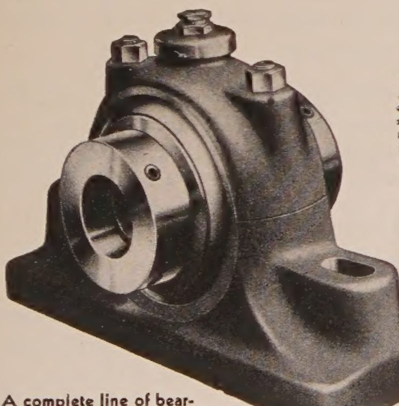


Combination iron and steel chains.

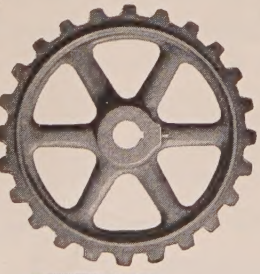
Gears — cast and cut tooth. A complete line of patterns.



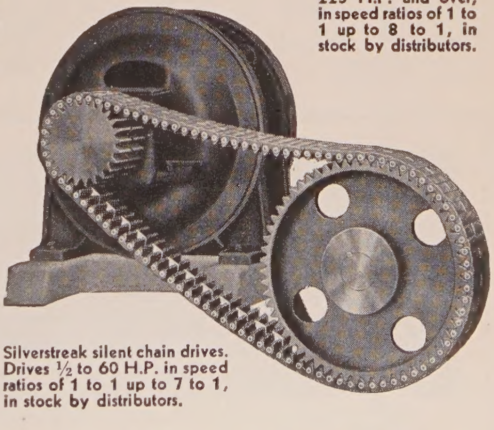
Silverlink roller chain drives. Drives up to 225 H.P. and over, in speed ratios of 1 to 1 up to 8 to 1, in stock by distributors.



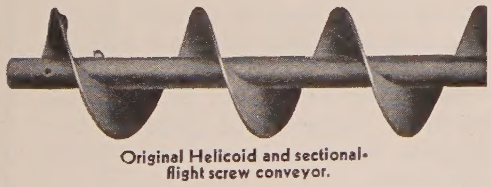
A complete line of bearings hangers, couplings, shafting and other power transmission equipment.



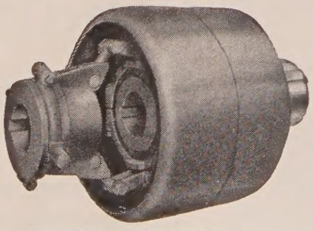
Cast tooth and cut tooth sprockets of all types.



Silverstreak silent chain drives. Drives ½ to 60 H.P. in speed ratios of 1 to 1 up to 7 to 1, in stock by distributors.



Original Helicoid and sectional-flight screw conveyor.



Clutches of various types.

CONVEYING & POWER TRANSMISSION MACHINERY ACCESSORIES

MILL EQUIPMENT

FIRECRETE, a new type, for casting light-weight refractory concrete on the job has just been announced by Johns-Manville. Known as L. W. (or light-weight) Firecrete, this new product is composed chiefly of high-alumina clay calcined at high temperatures. The manufacturers state that the resulting concrete weighs only 75 lb. per cu. ft.; that under continuous operation at 2,400 deg. F., shrinkage is so slight as to be entirely negligible; and that it has withstood the most severe alternate heating and cooling tests without spalling.

Light-Weight Firecrete

L. W. Firecrete, they say, is 40 per cent lighter than fire brick and has 40 per cent lower heat storage capacity. The material is particularly recommended for casting light-weight refractory shapes and for furnace doors and floors. It can be put in service, they say, after from 12 to 14 hours air-curing.

Manufacturers' News

ALLIS-CHALMERS Manufacturing Co., Milwaukee, Wisconsin, announces the removal of its Pittsburgh District Office to 2037 Koppers Building. Guy V. Woody is Manager of the Pittsburgh District.

Industrial Literature

KRANE KRAWLER (Bulletin No. 45) has just been issued by the Silent Hoist Winch & Crane Co., Brooklyn, N. Y.

Krane Kar is a gasoline engine driven swing boom crane, self-propelled on rubber tired wheels, and capable of traveling with the load on the hook. The equipment has many new and novel features conducive to utmost simplicity of operation and maximum safety under all conditions of use. Krane Krawler is a similar crane mounted on a gasoline or diesel crawler tractor.

●

MECHANICAL Rubber Goods catalog, published by the New York Belting and Packing Company of Passaic, N. J., is said to be a valuable addition to the reference library of engineers, purchasing agents, and other factory executives. It is said to have an unusual fund of practical information about hose, belting, packing, and miscellaneous mechanical rubber products.

●

HEAT TREATED forgings is the title of a new bulletin recently issued by Kropp Forge Co., Chicago. This bulletin announces *Forgings*, a 96-page catalog containing some 30 pages of tables of pertinent engineering facts, S.A.E. specifications, weights of rounds, squares and flats, temper colors, tensile strength tables, etc.

●

PRECAUTIONS and Safe Practices in the storage, care and handling of oxy-acetylene welding and cutting equipment—a new and complete edition—is being offered by The Linde Air Products Company, New York City.

Recommended Practices for Gas Cutting of Structural Steel is another addition to oxy-acetylene literature available.

●

MUREX Electrodes — Heavy Mineral Coated—is the title of a new booklet containing considerable technical data, including principles of design and operation, as well as physical properties and chemical analyses of deposited metals, issued by the Metal & Thermit Corporation, New York City. This 16-page booklet shows applications of various Murex Electrodes.

●

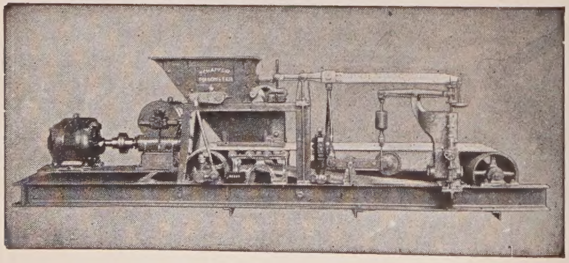
DUST, industry's nuisance, controlled becomes dust, a valuable by-product, says the Pangborn Corporation of Hagerstown, Maryland, in announcing their Bulletin No. 197, containing complete data on their type "CH" all metal, cloth screen dust collector.

●

TRAYLOR Engineering & Mfg. Co., Allentown, Pa., has recently distributed Circular No. 95 entitled "For Worthwhile Efficiency Bell-Shaped Crushing Heads Must Be Used With Curved Conclaves."

●

TYPE E Direct Current Motors and Generators is the title of a new 4-page leaflet (No. 2183) just distributed by Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin.



Schaffer Poidometers

are being used by many of the largest cement manufacturers for weighing and proportioning raw and finish materials; also for weighing and feeding coal to dryers. The latest installation being four Poidometers for weighing and feeding clinker and gypsum into Hercules mills at the Iola, Kansas plant of the Lehigh Portland Cement Company.

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